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INSTRUCTION MANUAL

for

GENERAL ELECTRIC CO.
Instrumentation & Control
228 W. Florence Ave.
Inglewood, Calif. 90301

Panoramic electronics, inc.

PANORAMIC ELECTRONICS, INC.
520 South Fulton Avenue, Mount Vernon, N.Y. • Phone: OWens 9-4600

INSTRUCTION MANUAL

FOR

PANORAMIC

SPECTRUM ANALYZER

MODEL SB-8b

TYPE T-10,000

PANORAMIC
ELECTRONICS, INC

520 South Fulton Ave., Mt. Vernon N.Y. • OWens 9-4600 •
TWX: MT-V-NY-5229 • Cables: Panoramic, Mt. Vernon, N.Y. State

TABLE OF CONTENTS

Page

CHAPTER I - INTRODUCTION

I-1. General 1
I-2. Applications 1
I-3. Equipment Supplied 1
I-4. General Description 2
I-5. Electrical Characteristics 5
I-6. Physical Characteristics 6
I-7. Operating Controls 15
I-8. Tube Complement 18
I-9. Terms and Definitions 20

CHAPTER II - INSTALLATION

II-1. Initial Inspection 21
II-2. Mounting 21
II-3. Equipment Cabling 21
II-4. Preliminary Adjustments and Checks 23

CHAPTER III - OPERATION

III-1. General Operation 27
III-2. Relative Amplitude Measurements 27
III-3. Operation with Differential Markers 28
III-4. Narrow Band Analysis 28
III-5. Operating Procedure for Pulsed Signals 33
III-6. Interpretation of Signals 33

CHAPTER IV - THEORY OF OPERATION

IV-1. Introduction 39
IV-2. Block Diagram Analysis 39
IV-3. Detailed Description of Preamplifier DA-1 41
IV-4. Detailed Description of Panalyzor, Model SB-8b 41
IV-5. Detailed Description of Power Supply PS-8b 51
IV-6. Detailed Description of Constant-Voltage Transformer 53

Page

CHAPTER V - SERVICE AND MAINTENANCE

V-1.	Test Equipment	55
V-2.	Equipment Adjustments	55
V-3.	Troubleshooting	57
V-4.	Alignment Procedure	67
V-5.	Voltage and Resistance Measurements	73
V-6.	List of Replaceable Parts	76

LIST OF ILLUSTRATIONS

Figure	Title	Page
I-1.	Presentation of Radio Frequency Spectrum	3
I-2.	Outline Dimensional Drawing, Model SB-8b, Cabinet Mounted Style	7
I-3.	Outline Dimensional Drawing, Model SB-8b, Rack Mounting Style	8
I-4.	Outline Dimensional Drawing, Model PS-8b, Cabinet Mounted Style	9
I-5.	Outline Dimensional Drawing, Model PS-8b, Rack Mounting Style	10
I-6.	Outline Dimensional Drawing, Panalyzor, Model SB-8b, and Power Supply, Model PS-8b, Mounted in a Common Cabinet	11
I-7.	Outline Dimensional Drawing, Preamplifier, Model DA-1, Cabinet Mounted Style	12
I-8.	Outline Dimensional Drawing, Preamplifier, Model DA-1, Rack Mounting Style	13
I-9.	Outline Dimensional Drawing, Constant-Voltage Transformer	14
I-10.	Front Panel Controls, Model SB-8b	16
II-1.	Interconnecting Diagram	22
III-1.	Ringing as an Indication of Optimum Resolution	29
III-2.	Resolution Nomograph	31
III-3.	Minimum Frequency Separation Δ F (KC) Required to Measure Amplitude Ratios E_2/E_1	32
III-4.	Resolution of Signals of Unequal Amplitude	32
III-5.	Measurement of Closely Spaced Unequal Amplitude Signals	33
III-6.	Constant Carrier Presentation	34
III-7.	A-m Signal Presentations	34
III-8.	F-m and Pulsed R-f Signals	35
III-9.	Resolution of Interfering Signals	36
III-10.	Typical Screen Presentations of Noise Signals	37
III-11.	Screen Presentations of Noise Signals Using Wide I-f Bandwidth and VIDEO FILTER	38

LIST OF ILLUSTRATIONS (cont.)

Figure	Title	Page
IV-1.	Functional Block Diagram, Model SB-8b	40
IV-2.	Schematic Diagram, Model DA-1	42
IV-3.	Resultant Output of R-f Stage	43
IV-4.	Relationship of R-f Signal Frequencies and Oscillator Sweep Frequencies	46
IV-5.	Indications of Resolution	47
IV-6.	Schematic Diagram, Power Supply, Model PS-8b	52
IV-7.	Schematic Diagram, Constant-Voltage Transformer	53
V-1.	Adjustment Locations (Panalyzor)	56
V-2.	Bottom View of T101 and T102 Showing Location of Overcoupling Coil Adjustment	70

ADDENDUM

Model SB-8b, Type T-10,000, Serial Numbers 31L--- and above
and Serial Numbers 32L--- and above

The second i-f frequency has been changed to 650 KC. To cover this modification, the following changes should be made in the text of this Instruction Manual.

Page 4, Paragraph e.

Change 500 KC to read 650 KC.

Page 30.

Change 500 KC to read 650 KC.

Page 46, Paragraph g.

Change 500 KC to read 650 KC.
Change 22.5 MC to read 22.35 MC.

Page 48, Paragraph h.2.(c).

Change 500 KC to read 650 KC.

The following changes should be made in the list of replaceable parts.

Change to read:

Circuit Ref Symbol	Description	Mfr. & Mfrs. No.	Qty. In Set
C980	Capacitor: fixed, silvered mica, 47 uuf, ±5% Pan Part CM15C470J	AD CM15C470J	1
Z104	Transformer: coil, oscillator 22.35 MC Pan Part ZN8415	BC ZN8415	1

Circuit Ref Symbol	Description	Mfr. & Mfrs. No.	Qty In Set
Z105	Transformer: r-f coil, tapped, 650 KC Pan Part ZN8263	BC ZN8263	1
Z106	Transformer: r-f, 650 KC Pan Part ZN8416	BC ZN8416	1
Z107	Transformer: r-f, 650 KC Pan Part ZN8417	BC ZN8417	1
C25			1

CHAPTER I - INTRODUCTION

I-1. GENERAL.

This Instruction Manual contains information concerning electrical and physical characteristics, applications, installation, and operation of the Panoramic Panalyzor, Model SB-8b, Type T-10,000.

No attempt to operate the equipment should be made until the user is thoroughly familiar with the information contained in CHAPTER III - OPERATION.

I-2. APPLICATIONS.

The Panoramic Panalyzor, Model SB-8b, in conjunction with a suitable signal generator and mixer, provides a visual automatic spectrum analysis of amplitude modulated (am), frequency modulated (fm) and pulsed systems, crowded communications channels, instabilities of oscillators, noise spectra, and other dynamic phenomena. Non-professional personnel in laboratory or factory can easily use the Panalyzor once the norms for its application are established. The unit permits selection of center frequency, sweep width, sweep rate, resolution, and type of amplitude indication. The direction and magnitude of conditions, due to changing loads, carrier shifts, mechanical shocks, etc., can be seen instantly. Its wide range of frequency coverage aids in studies of harmonic output.

F-m signals are seen as a carrier flanked by its Bessel function sidebands. F-m static deviations may be calculated by noting the zero-amplitude levels of either the carrier or adjacent sidebands. Modulated signal displays may be used to measure energy distributions and to look for such effects as unwanted or excessive modulations, linearity of deviations, hum and noise, and otherwise undetectable parasitic oscillations.

The variable resolution and variable sweep rate of the Panalyzor are especially suited to pulsed radio frequency (prf) analysis as in radar systems. The one-per-second rate permits good visual description of low prf dispersions. Provision is made to reduce intermediate frequency (if) bandwidth in order to assure adequate amplitude response for narrow pulses. An intensifier is included to brighten pulse displays.

I-3. EQUIPMENT SUPPLIED.

The equipment listed below can be supplied in individual cabinets or in rack mounting assemblies. Preamplifier, Model DA-1, with connecting cables, can be supplied as optional equipment.

Nomenclature	Quantity
Panalyzor, Model SB-8b	1
Power Supply, Model PS-8b	1
Constant-Voltage Transformer	1
R-f input cables W3001	2
Interconnecting cable W3046	1
Preamplifier, Model DA-1*	1

*Optional equipment

Identification of the equipment described in this manual is found on front panel nameplates and rear apron patent labels.

I-4. GENERAL DESCRIPTION.

Model SB-8b is an automatic scanning receiver which permits visual analysis of selected microwave signals within a zero-to ten-megacycle band. Each signal within the band being scanned is displayed on a cathode-ray tube screen as a pip or group of pips depending upon the nature of the signal. The amplitudes and positions of these pips along the calibrated horizontal axis are indicative of their signal levels and frequencies respectively. A more functional description of the equipment is presented in the following paragraphs.

a. Panoramic Panalyzor, Model SB-8b. The Model SB-8b is designed to operate in conjunction with a receiver or signal source, and an external signal generator. The signal source and external generator signal are heterodyned at the equipment input to produce the 30-megacycle input center frequency required by the Panalyzor. This combination forms a microwave spectrum analyzer whose frequency range is limited only by the external generator.

Panalyzor sweep width is continuously variable from ±5 megacycles to zero. The width may be determined quantitatively from ±50 kilocycles to ±5 megacycles by means of internal differential markers, supplied as an option. Either wideband observation of a spectrum as large as 10 megacycles or very high resolution analysis of small sections is readily accomplished. Frequency components of the input signal appear dispersed along the linearly calibrated horizontal scale of the crt screen as inverted V-shaped pips. Figure I-1 illustrates a portion of the r-f spectrum. The circle represents the range of pips visible on the Panalyzor screen. These pips indicate frequencies of signals with respect to a signal at the screen center. Each signal produces its own pip or group of pips which help identify and analyze the signal. Respective amplitudes may be measured by reading the pip heights along any of the three vertical scales, linear (calibrated in 10 divisions), logarithmic (calibrated from +20 db to -20 db in 5-db steps) or the expanded square law scale.

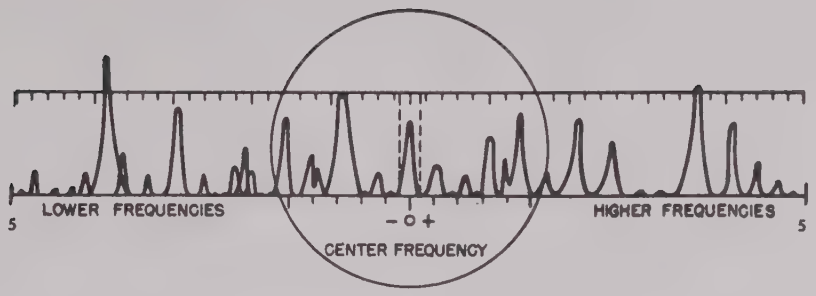


Figure I-1. Presentation of Radio Frequency Spectrum.

The latter is convenient for determining power points (half-scale deflections being half-power), signal location in pulsed rf, and critical comparisons between signals or sidebands of similar amplitudes. Sensitivity specifications for the Panalyzor are listed in Section I-5. ELECTRICAL CHARACTERISTICS. When sensitivities greater than those specified for the standard equipment are required, the use of Preamplifier, Model DA-1, is recommended.

b. Preamplifier, Model DA-1. Preamplifier, Model DA-1, supplied as optional equipment, is designed to increase the direct sensitivity of the Panalyzor. Input impedance to the Preamplifier is 50 ohms. When used to amplify low level signals, the step attenuator is adjusted to obtain a suitable signal to noise level.

c. Signal Presentation. Variable sweep rates and resolutions are provided in the Panalyzor. Any rate from 1 to 60 sweeps per second may be selected in free-running mode or with synchronization to line or external source. This provision is employed to obtain stationary displays with a very wide range of pulse repetition frequencies, thus showing the time analysis in addition to the spectrum distribution. Pulse skipping is immediately apparent. When analyzing signals with closely spaced sidebands, lower sweep rates are used to take full advantage of the resolving capabilities of the variable i-f filter. At its most selective setting, the r-f section will separate signals 9 kilocycles apart. The RESOLUTION control may be adjusted for optimum visual separation once the sweep width and sweep rate are selected for a particular measurement.

d. Cathode-Ray Tubes. The standard indicator provided with the Panalyzor is the high persistence type 5UP7, but any other requested phosphor can be furnished. The Panalyzor is also available with a camera mount bezel, flat face type 5ADP7 (or other phosphor) crt, and edge illumination. Standard 5-inch oscillograph camera hoods are conveniently attachable to this bezel.

e. Basic Operation. The functions described below represent the basic operation of the equipment. Inputs to the Panalyzor are heterodyned together. The difference frequency produced is amplified and applied to another mixer stage to beat with the Panalyzor sweeping-oscillator frequency.

The sweeping-oscillator is frequency modulated by a sawtooth-driven reactance-modulator stage, controlled by the setting of the SWEEP WIDTH control. This oscillator is of push-pull design with excellent frequency stability. It incorporates a feedback network which simultaneously counteracts variations in oscillator amplitude and random frequency modulation. During its frequency excursions, the oscillator successively heterodynes with each of the signals present in the mixer, and produces a series of i-f signals to be amplified in the sharply tuned i-f stages.

The selectivity of the i-f stages is controlled by changing the loading in a dual-Q multiplier. The successive i-f pulses are applied through diode detector and a d-c coupled video amplifier to the vertical plates of the cathode-ray tube.

Linear amplification of voltage is used for the LIN scale presentation. A logarithmic compression feedback circuit is used for the LOG scale presentation. A square-law detector circuit is used for the EXP presentation. D-c coupling permits examination of c-w signals using very small sweep widths. A capacitive video filter serves to eliminate annoying irregularities in pip shapes when displaying closely spaced signals.

The Panalyzor is a dual conversion type. The first i-f stage, tuned to 23 megacycles, attenuates any spurious signals caused by mixing input signals with harmonics of the sweeping-oscillator frequency. The 23-megacycle signal is then applied to the following i-f stage. This stage converts the input frequency and produces at its output the second i-f of 500 kilocycles.

A phantastron-type oscillator provides a linear sawtooth waveform which serves a dual purpose. It is applied, simultaneously, to the horizontal plates of the indicator, and to the reactance modulator portion of the sweeping-oscillator circuit. The occurrence rate of the sawtooth can be varied from 1 to 60 cps by varying the SWEEP RATE control located on the front panel. Thus, the horizontal axis of the screen display is effectively a frequency scale. It is calibrated to a tolerance of ± 1 percent about the center frequency.

When a differential marker sub-chassis is provided, sweep width markers are produced by two high-capacitance Hartley-type oscillators, tuned by varying a dual air-capacitor. Second harmonic frequencies are equally spaced above and below the 30-megacycle input center frequency of the Panalyzor. The front panel marker dial indicates this second harmonic frequency difference, which serves as a calibration for the SWEEP WIDTH control. A con-

venient by-product of this circuit is the 30-megacycle sum frequency of the fundamentals. When markers are used, the horizontal positioning of the input center frequency indication can be checked by the sum frequency pip.

High inherent stability of the sweeping-oscillator is attained because of the comparatively low frequency of the Panalyzor. The oscillator circuitry contains miniature low power tubes, allowing a d-c rectifier to be used for the heater supply. This provision insures freedom from the common annoyance of hum modulation on the signal displays. Display intensity, focus and astigmatism are easily adjusted for clear well defined traces.

I-5. ELECTRICAL CHARACTERISTICS.

The following specifications apply to the overall characteristics of the Panalyzor.

Sweep Width (Frequency Dispersion)	Continuously variable 0 - 10 MC
Resolution (Frequency separation of two signals of equal amplitudes, measured at their intersection, 3 db down from peaks)	Continuously variable 9 KC to 80 KC
Input Impedance	50 ohms
Sensitivity for full scale linear deflection	-75 dbm -100 dbm with Preamplifier, Model DA-1
Differential Marker	Continuously variable ± 50 KC to ± 5 MC
Amplitude Scales (vertical crt calibration)	Linear, Logarithmic and Exponential

LIN(ear) is linear amplification in voltage (-6 db equals half-scale)

LOG(arithmic) is compression in voltage (-20 db equals half-scale)

EXP(onential) is linear in power amplification (-3 db equals half-scale) or expansion in voltage (power ratio = voltage ratio squared)

Visual Display Tube	5UP7 or optional 5ADP7 with edgelit reticle and camera mount bezel.
Power Source	115 VAC nominal, 60 cps, single phase. Others by request.
Power Consumption	135 watts

I-6. PHYSICAL CHARACTERISTICS.

Physical characteristics of the Panalyzor units are specified below.

a. Weights.

Model SB-8b Panalyzor	28 lbs (approx.)
Power Supply, PS-8b	33 lbs
Constant-Voltage Transformer	24 lbs
Preamplifier, Model DA-1	10 lbs
Cabinet, Panalyzor Unit	28 lbs
Cabinet, Power Supply Unit	12 lbs
Cabinet, Preamplifier, Model DA-1	6 lbs

b. Dimensions.

Panalyzor, Model SB-8b, Cabinet Mounted Style	See Figure I-2
Panalyzor, Model SB-8b, Rack Mounting Style	See Figure I-3
Power Supply, Model PS-8b, Cabinet Mounted Style	See Figure I-4
Power Supply, Model PS-8b, Rack Mounting Style	See Figure I-5
Model SB-8b and Model PS-8b in Common Cabinet	See Figure I-6
Preamplifier, Model DA-1, Cabinet Mounted Style	See Figure I-7
Preamplifier, Model DA-1, Rack Mounting Style	See Figure I-8
Constant-Voltage Transformer	See Figure I-9

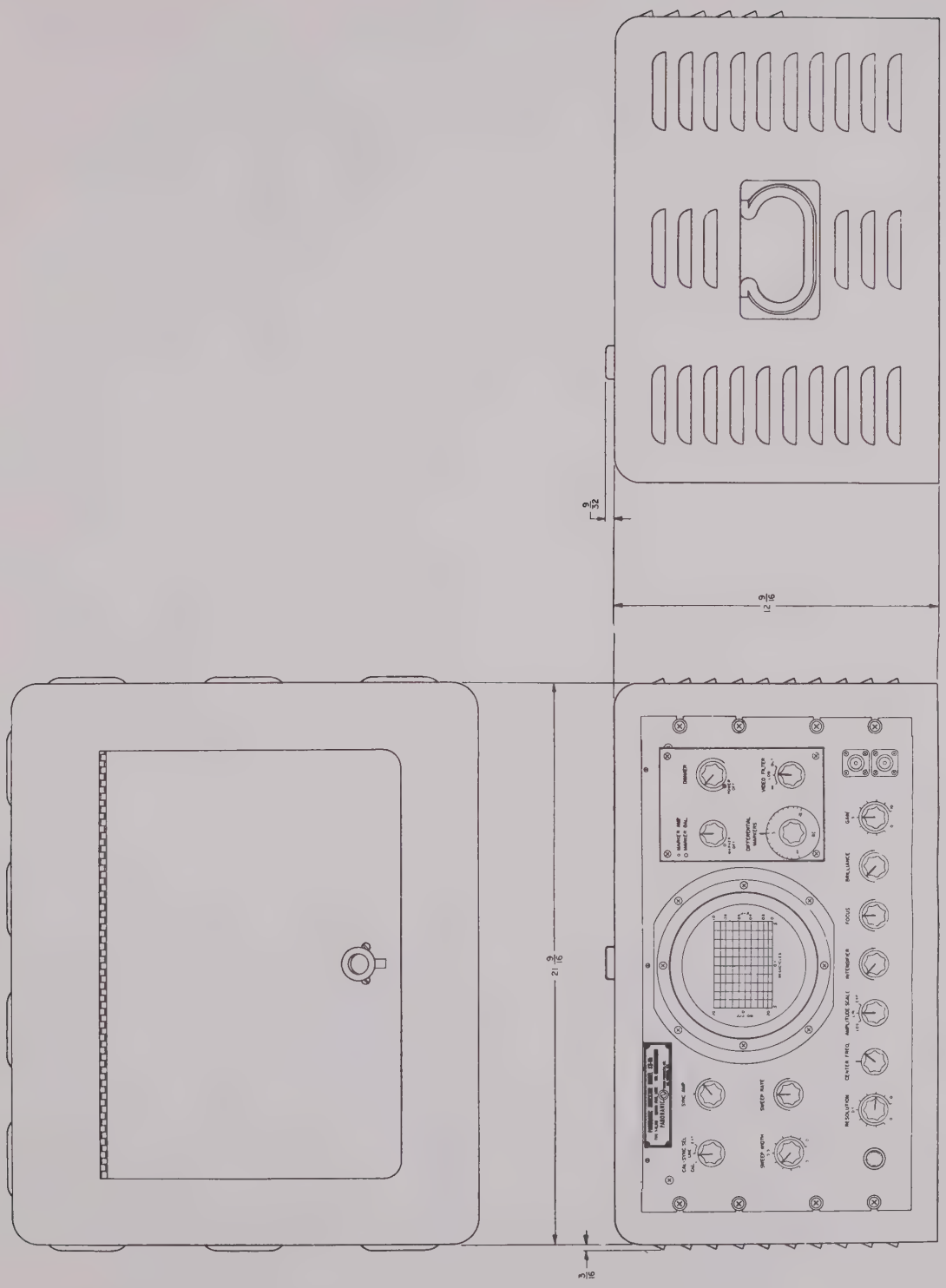


Figure I-2. Outline Dimensional Drawing, Model SB-8b, Cabinet Mounted Style.

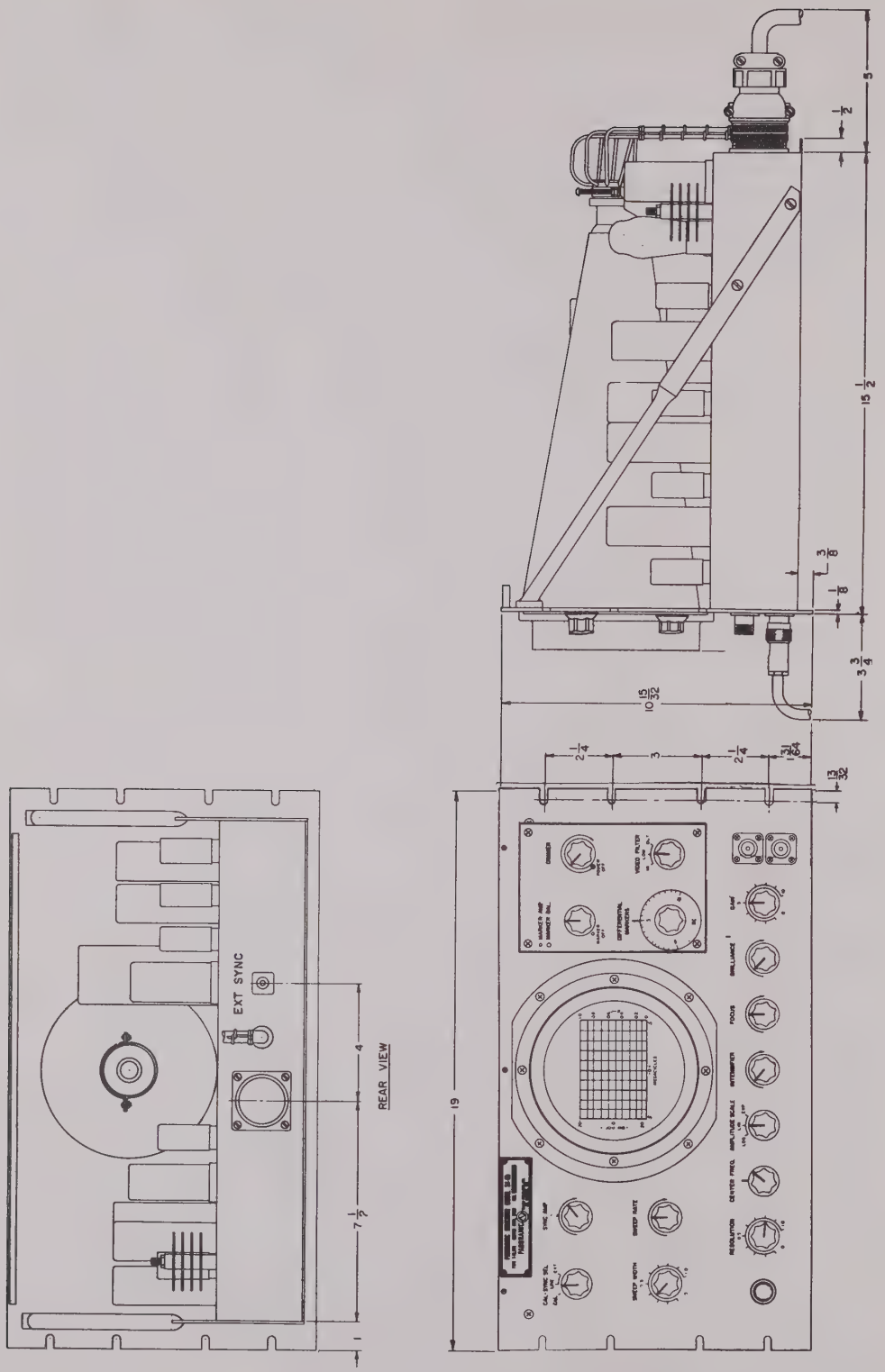


Figure I-3. Outline Dimensional Drawing, Model SB-8b, Rack Mounting Style.

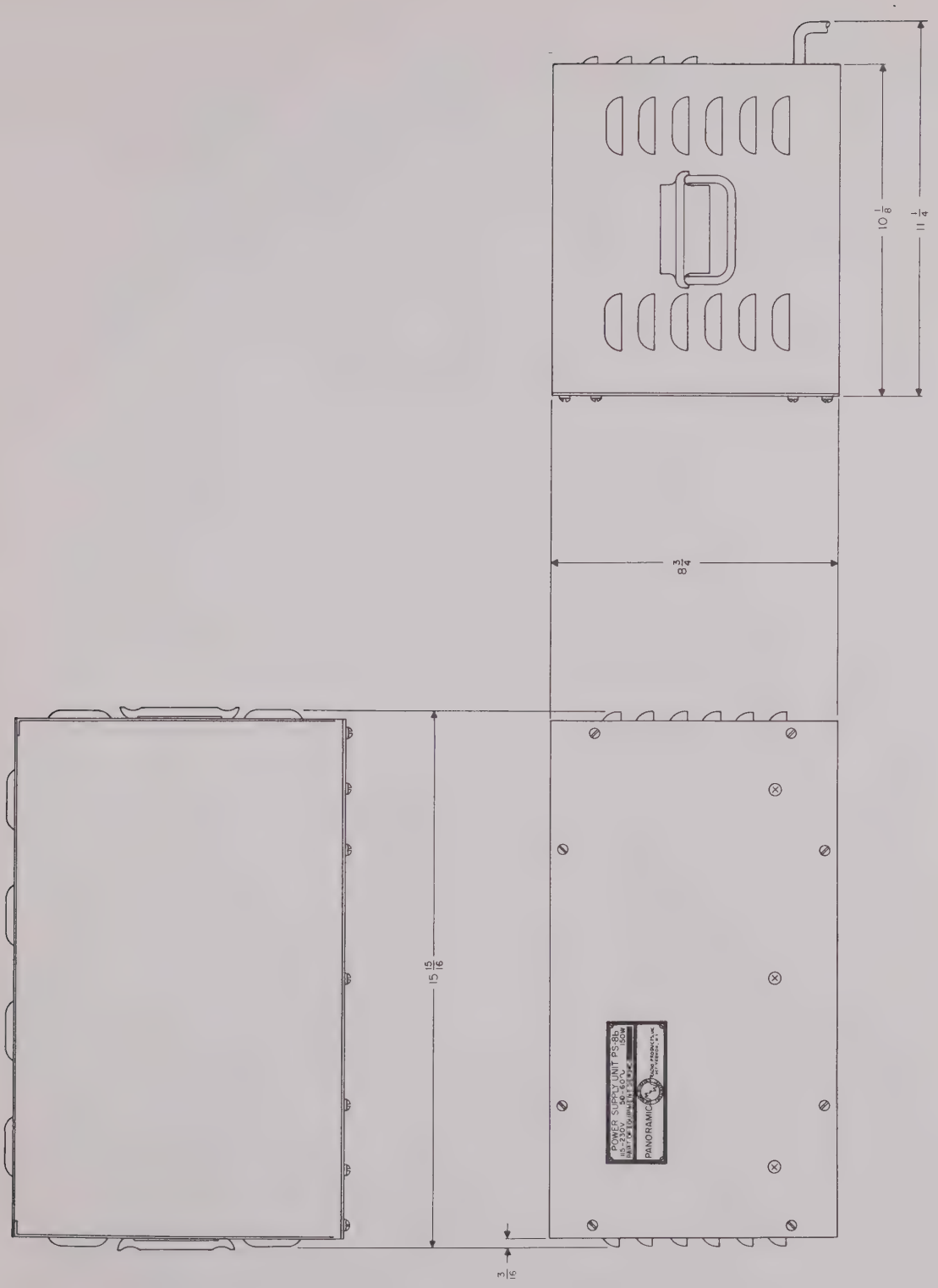


Figure I-4. Outline Dimensional Drawing, Model PS-8b, Cabinet Mounted Style.

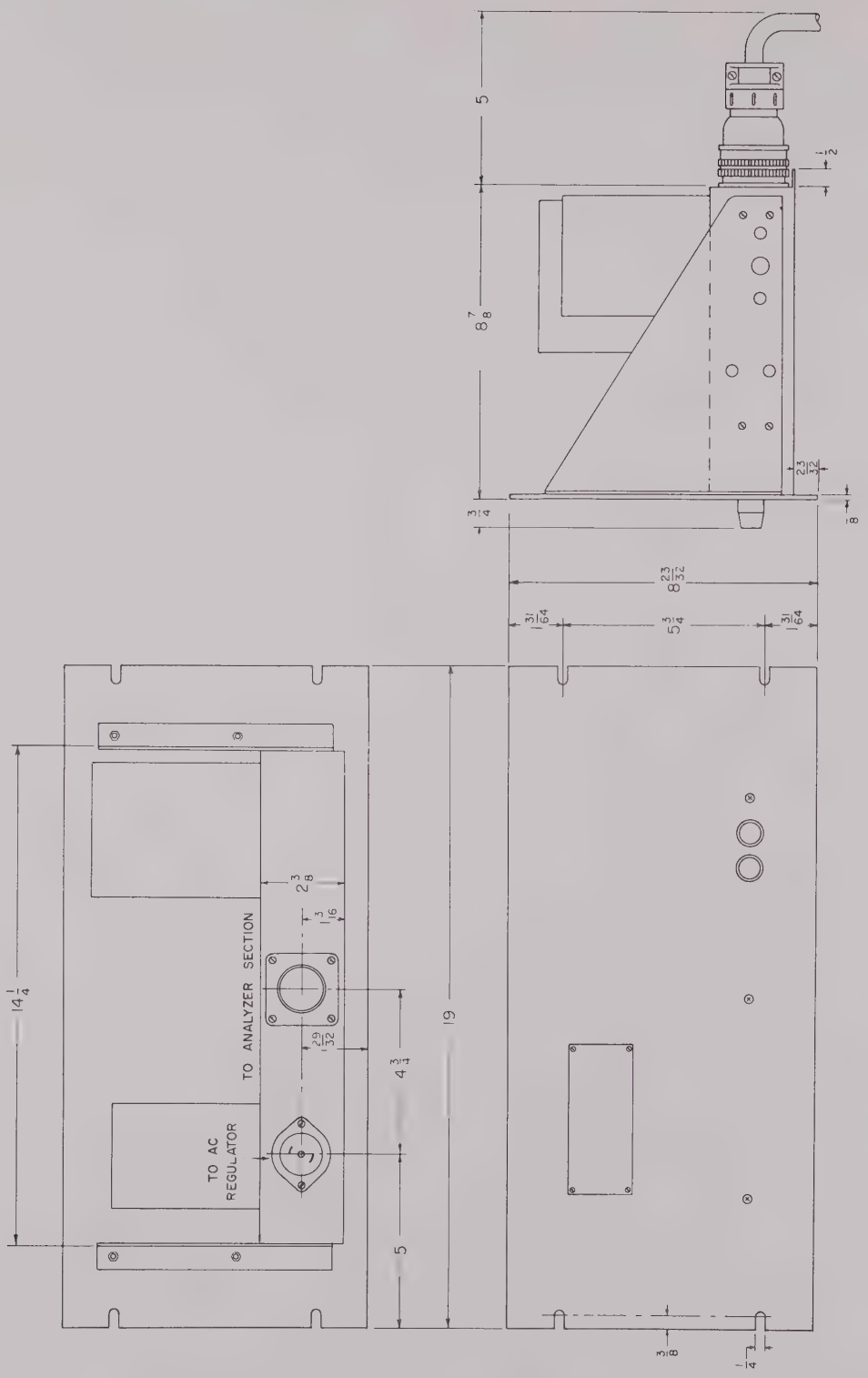


Figure I-5. Outline Dimensional Drawing, Model PS-8b, Rack Mounting Style.

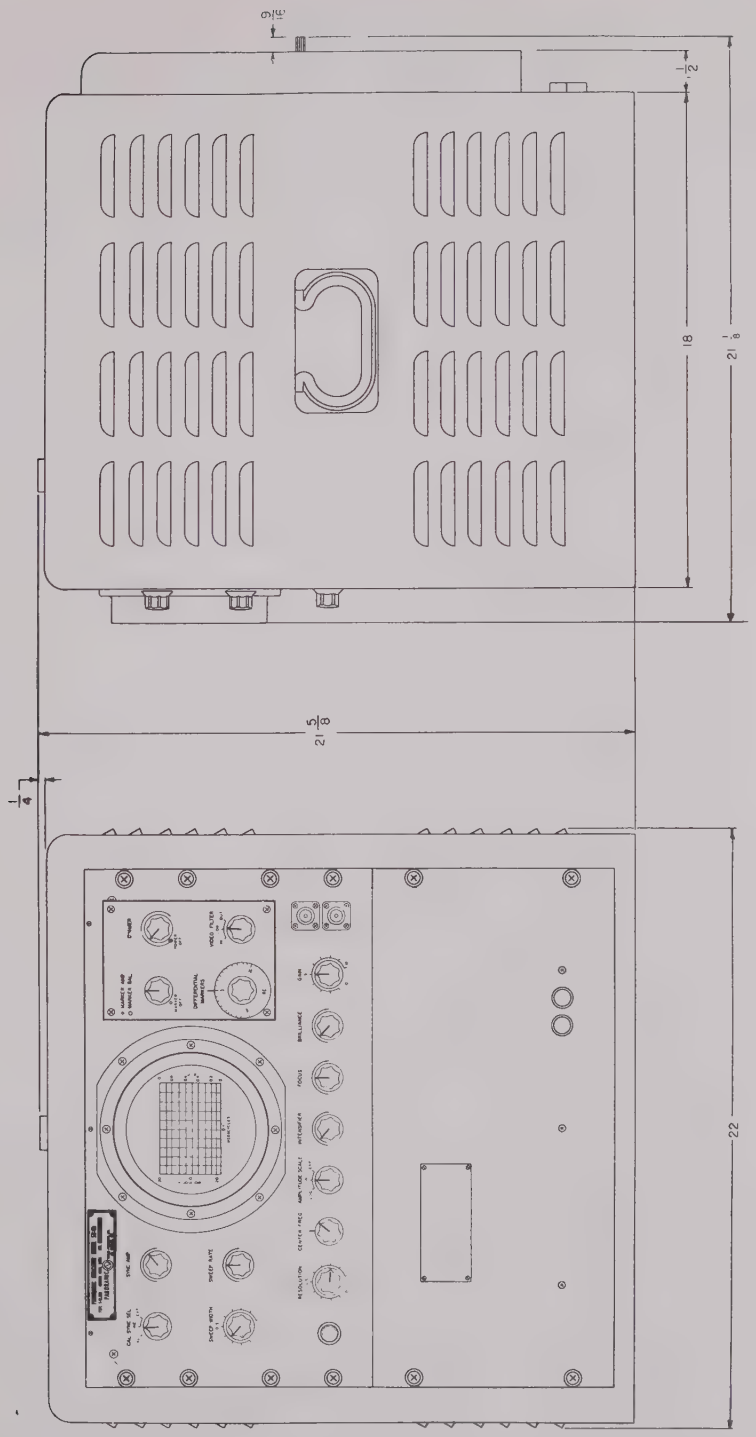


Figure I-6. Outline Dimensional Drawing, Panalyzor, Model SB-8b, and Power Supply, Model PS-8b, Mounted in a Common Cabinet.

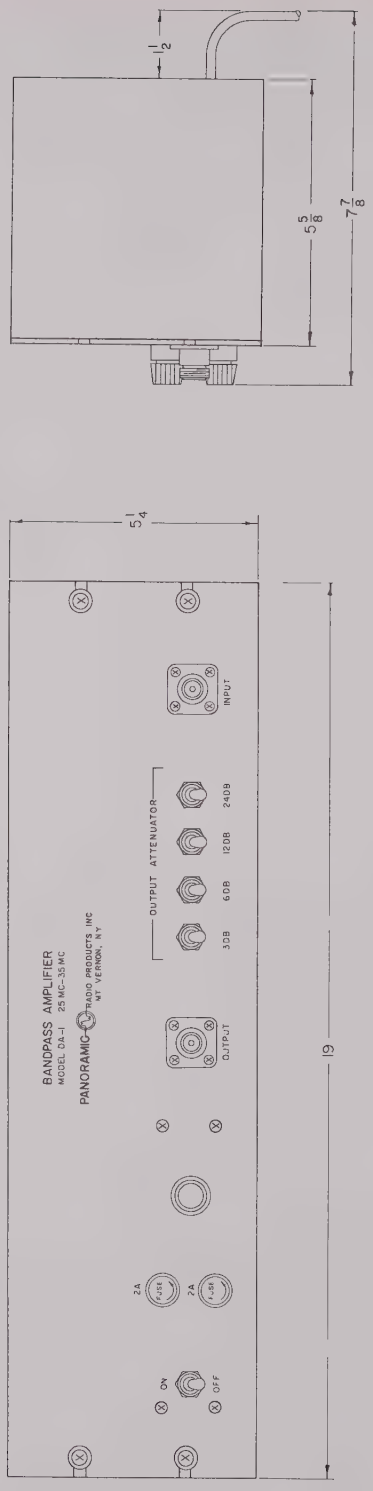


Figure I-7. Outline Dimensional Drawing, Preamplifier, Model DA-1, Cabinet Mounted Style.

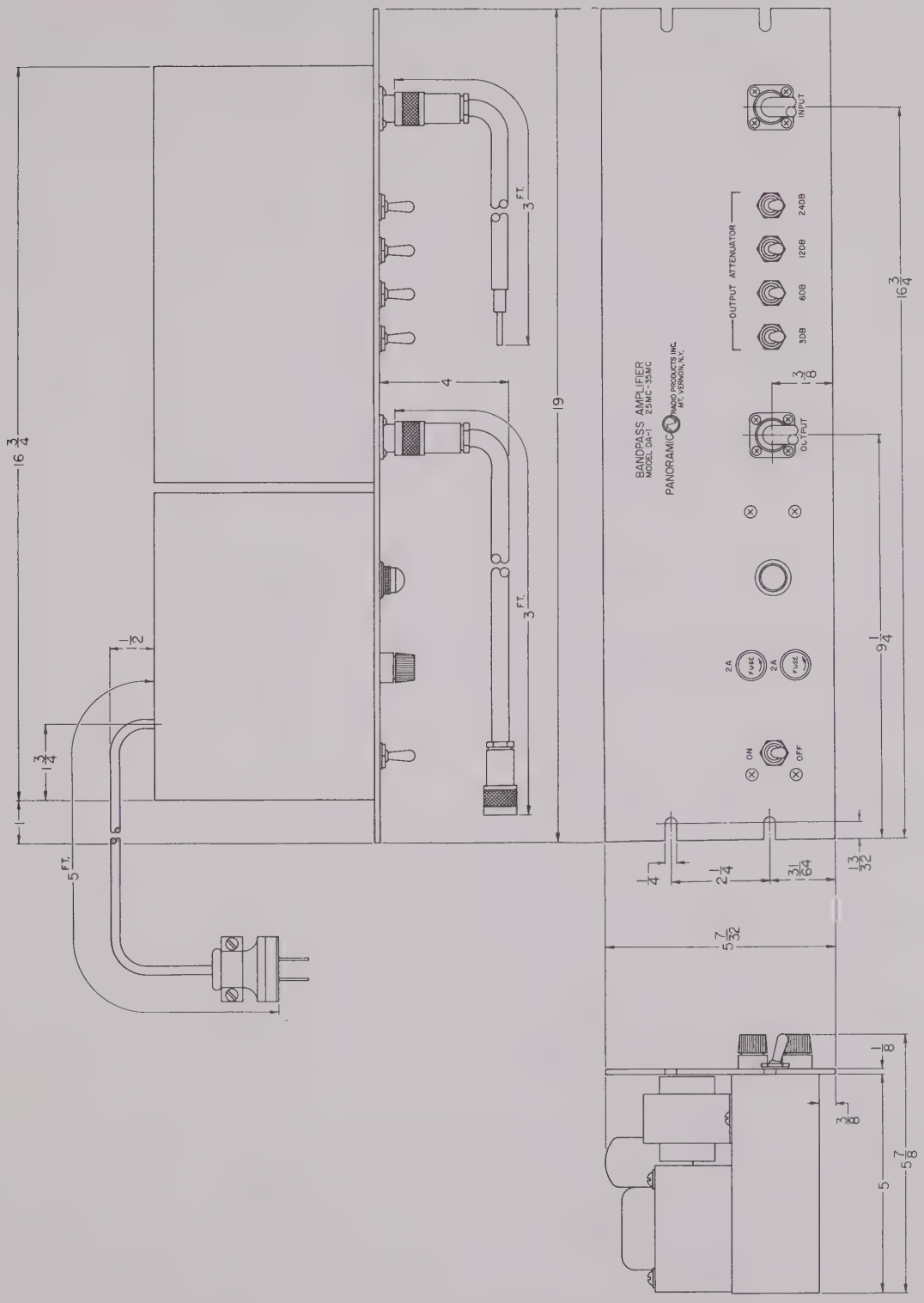


Figure I-8. Outline Dimensional Drawing, Preamplifier, Model DA-1, Rack Mounting Style.

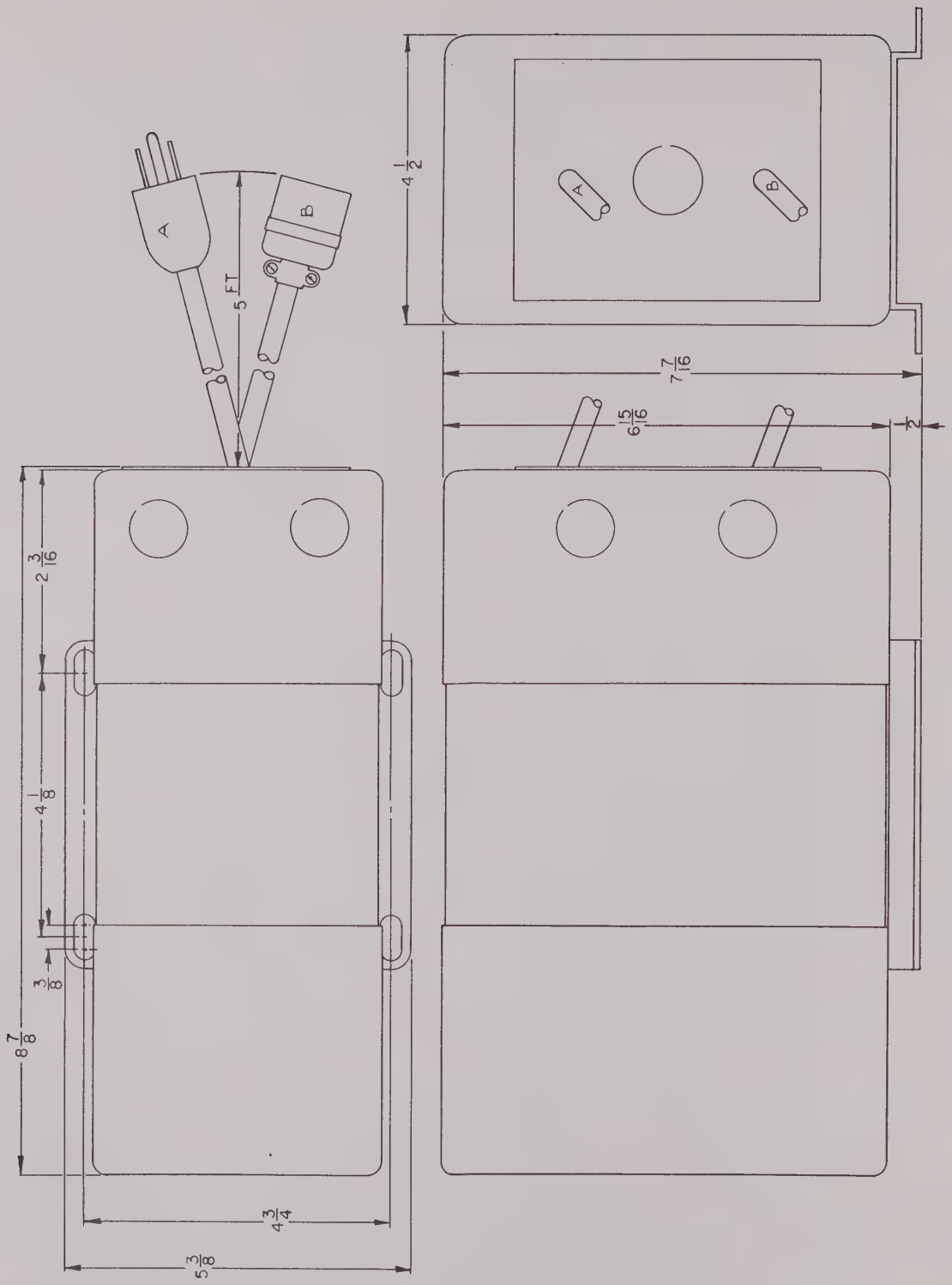


Figure I-9. Outline Dimensional Drawing, Constant-Voltage Transformer.

I-7. OPERATING CONTROLS.

Operating controls and their functions are listed in the following paragraphs. The controls are mounted on the front panel of the Panalyzor. See Figure I-10 for their identification and location.

CENTER FREQ. control (1) serves to restore or maintain the sweeping-oscillator at its specified mean frequency, causing a deflection corresponding to the input center frequency to appear at the center of the screen. This control may be used as an uncalibrated fine adjustment in conjunction with the external generator. It should not be used at wide sweep widths to bring signals outside the edges of screen calibrations. This causes the Panalyzor to operate beyond its bandpass region.

RESOLUTION control (2) is used to adjust i-f bandwidth. Counterclockwise rotation of this control narrows the width of the second i-f section. As this control is adjusted, there will be some degree of change in the sensitivity of the equipment.

AMPLITUDE SCALE control (3) is a three-position rotary switch, allowing selection of logarithmic (LOG position), linear (LIN position), or square-law expanded (EXP position) presentations. LOG position is used when the amplitude ratio of frequency components is large. In this position, the calibration dots on the left side, representing +20 db to -20 db in 5-db separations, are used for measurement.

LIN position is used when the amplitude ratio is 20 db (10:1) or less. Calibrated horizontal lines dividing the screen into 10 equal sections are used in this position. An associated scale is provided on the right side of the crt screen. EXP position is used primarily to measure and compare small differences between peak levels of signals. Deflection heights of signals on the screen are proportional to power. Full-scale deflection in LIN position equals half-scale deflection in LOG position. A half-scale signal on LOG scale may be increased in amplitude 10 times before reaching full-scale deflection. Thus, in LOG position, signals of great amplitude are compressed and viewed without the necessity of adjusting gain controls in associated equipment.

To measure differences in peak levels when in EXP position, adjust a higher peak to full scale and observe the portion of the scale covered by a lower peak. Deflection is proportional to the square of the input voltage. Should the lower peak measure 1/4 scale, the input voltage ratio between peaks would be $1:\sqrt{4}$ or 1:2. The circuit is accurate only above 1/4 scale, therefore, it is limited to a 4:1 full-scale power ratio. Because of a-c coupling the EXP feature functions properly only with narrow pips and/or fast sweeps.

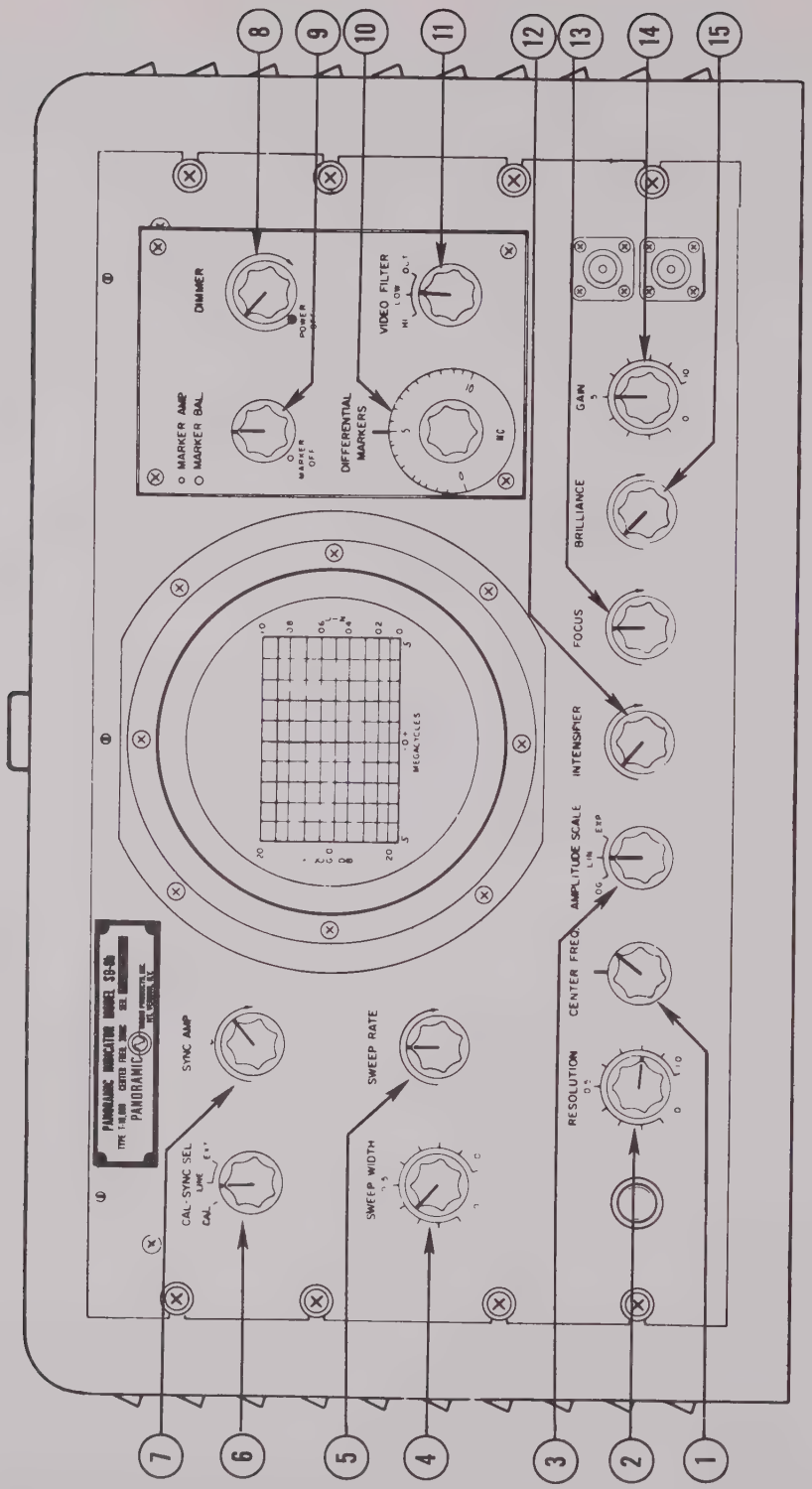


Figure I-10. Front Panel Controls, Model SB-8b.

SWEEP WIDTH control (4), adjusts the width of the spectrum segment being scanned. When turned completely clockwise, the maximum spectrum width of 10 megacycles is displayed. Counterclockwise rotation narrows the bandwidth displayed across the screen. The control markings are approximations. This control, in conjunction with the RESOLUTION control, is useful for separating two or more merged signal deflections.

SWEEP RATE control (5) provides continuously adjustable linear sweep rates between 1 cps and 60 cps. Counterclockwise rotation results in reduced sweep rate.

CAL-SYNC SEL control (6) is a three-position switch which permits selection of three synchronization methods. In CAL position, calibration of sweep rate is accomplished by injecting power line frequency into the vertical deflection circuit. In LINE position, sweep is synchronized with power line frequency or an exact submultiple of line frequency. In EXT position, sweep synchronism is controlled from an external sweep signal source. This signal must be applied to the Ext Sync receptacle on the rear apron of the Panalyzor chassis.

SYNC AMP control (7) adjusts the amplitude of the sweep-synchronizing signal (internal or external). Maximum amplitude occurs at maximum clockwise position.

DIMMER control (8), when rotated clockwise, applies power to the Panalyzor and controls lamp illumination. Continuing clockwise rotation increases edge illumination of the screen on equipments using a type 5ADP7 crt. On sets with a type 5UP7 crt, the control dims the front panel pilot light. The on-off section of the switch does not control power to the constant-voltage transformer.

MARKER AMP and MARKER BAL control (9) is a dual concentric control and adjusts marker pip height. When inner knob (MARKER AMP) is turned fully counterclockwise, markers are turned off. With clockwise rotation, markers are turned on; further rotation increases the marker pip amplitude. Outer knob (MARKER BAL) is used to compensate for equipment response characteristics and equalize pip heights.

DIFFERENTIAL MARKERS control (10) is a tuning dial scribed with calibrated indices and numbered at 0, 5, and 10. It is used to indicate the frequency differential between markers. If the marker dial indicates 5, there is a 5 megacycle distance (independent of signal frequency) between the two markers. Normal operation requires that the two marker pips be equidistant from the center frequency point, therefore, an indication of 5 on the dial is interpreted as ±2.5 megacycles of center frequency.

VIDEO FILTER control (11) is a three-position switch (HI, LOW, OUT) that provides two degrees of video filtering to suppress unwanted effects as noise, hum, and spurious beating between adjacent signals. Signal pips will be integrated and shifted slightly when switching the filter to either HI or LOW position.

INTENSIFIER control (12) is turned clockwise when observing pulsed or noise signals. These signals will then intensity modulate the crt beam. By turning the BRILLIANCE control until the baseline is barely visible, intensity modulated signals will appear on the screen in greater contrast.

FOCUS control (13) adjusts the sharpness of the crt presentation.

GAIN control (14) adjusts the height of signal deflections displayed on the crt screen. Use low gain whenever possible to minimize both spurious and noise deflections. Clockwise rotation increases amplifier gain.

BRILLIANCE control (15) varies the intensity of the crt presentation. Clockwise rotation increases brilliance.

I-8. TUBE COMPLEMENT.

Reference designations, types, and functions of tubes used in the Panalyzor are listed below.

a. Model SB-8b Panalyzor.

Circuit Reference Designation	Tube Type	Function
V1	6BE6	Signal Mixer
V2	6AH6	Bandpass Amplifier
V3	6J6	Mixer
V4	6AH6	Reactance Modulator
V5	6AH6	Reactance Modulator
V6	6J4	Sweeping Oscillator
V7	6J4	Sweeping Oscillator
V8	12AU6	Limiter
V9	6CB6	1st I-f Amplifier
V10	6BE6	2nd I-f Amplifier and Converter
V11	12AT7	1st Video and Q Multiplier
V12	-	Not Used
V13	6AH6	2nd Video Amplifier
V14	12AU7	Detector and Vertical Amplifier
V15	12AU7	Intensifier and Vertical Phase Inverter
V16	12AT7	Sync Amplifier

Circuit Reference Designation	Tube Type	Function
V17	6U8	Horizontal Sweep Generator and Cathode Follower
V18	12AU7	Horizontal Sweep Amplifier and Phase Inverter
V19	5UP7 or 5ADP7	Cathode-Ray Tube
V20	OD3	Voltage Regulator
V21	6U8	Astigmatism Control and Blanking Amplifier
V23	12AT7	Exponential Detector and Oscillator
V24	12AT7	Marker Oscillator
V25	12AT7	Marker Oscillator
CR1	16S1B1S1G	Selenium Rectifier Bridge Filament Supply
CR2	1N81A	D-c Restorer
CR960	1N34A	Oscillation Rectifier for Limiter
I-2	47	Keep Alive
I-10	NE-16 (Mod)	Sweep Oscillator Discharge

b. Model PS-8b Power Supply.

Circuit Reference Designation	Tube Type	Function
V101	5V4G	B+ Rectifier
CR1	V100HF	High Voltage Rectifier
CR2	V100HF	High Voltage Rectifier (used with 5ADP7)

c. Model DA-1 Preamplifier.

Circuit Reference Designation	Tube Type	Function
V1	6J4	Amplifier
V2	6J4	Amplifier
V3	6CB6	Amplifier
V4	6CB6	Amplifier
V5	6CB6	Amplifier
V6	6J4	Cathode Follower
V7	5Y3	Rectifier
V8	OA2	Voltage Regulator

I-9. TERMS AND DEFINITIONS.

The terms listed below are used throughout this manual and are defined for a better understanding of Panalyzor operation.

a. Panoramic Reception is simultaneous reception of signals contained in a continuous portion of the frequency spectrum. These signals are received at fixed, rapid intervals and appear to be continuous when viewed on a cathode-ray tube.

b. Sweep Width is the band observed by panoramic reception which corresponds to the range of oscillator sweep in panoramic equipment.

c. Baseline is the line produced by the electron beam sweeping horizontally across the cathode-ray tube.

d. Frequency Sweep Axis is a calibrated line scribed on the screen to indicate the frequencies of signals on either side of the center frequency.

e. Center Frequency is the frequency appearing over the zero on the frequency sweep axis with the SWEEP WIDTH control set for zero sweep.

f. Resolution is the frequency difference between the peaks of two signals of equal amplitude when they merge at a point 3 db down from peak amplitude. This frequency difference is measured along the frequency sweep axis. Smaller differences indicate better resolutions.

g. Sweep Rate is the number of times per second the electron beam sweeps horizontally across the cathode-ray tube.

h. Deflection Amplitude is the height of signal deflection measured from baseline to peak.

i. Sweeping Oscillator is the reactance oscillator used to modulate the mixer circuit to obtain panoramic reception.

j. Sweep Generator is the sawtooth generator used for horizontal sweep of the crt and modulation of the reactance oscillator.

k. Markers are calibrated beat oscillations injected into the 1st i-f amplifiers and displayed on the crt to estimate frequency separation of signals.

l. Line Size denotes the horizontal distance covered by the baseline. It is synonymous with horizontal gain.

CHAPTER II - INSTALLATION

II-1. INITIAL INSPECTION.

This instrument has been tested and calibrated before shipment. Only minor preparations are required to put the instrument in operational condition. The equipment is shipped with all tubes and crystals installed. Check that all such components are properly seated in their sockets.

If damage to the case is evident when delivery is made, have the person making the delivery note the damage on all delivery receipt copies and sign the notation. Most public carriers do not recognize claims for concealed damage if such damage is not reported within fifteen days after delivery. All shipping containers should be opened and equipment inspected before fifteen days elapse. If damage is found, whether concealed or obvious when delivered, call or write the carrier and ask that an inspection be made by their agent. Although the carrier is liable for any damage in the shipment, Panoramic Radio Products, Inc. will assist in describing and providing for repair or replacement of damaged items.

II-2. MOUNTING.

The equipment should be located in an area where sufficient ventilation is available and ambient light is not excessively bright. Do not use the BRILLIANCE control to compensate for light falling on the screen. Locate the constant-voltage transformer as far from the Panalyzor unit as possible to minimize hum pickup.

The constant-voltage transformer should be mounted with the nameplate right side up. This will place the ventilated compartment downward, providing cooler capacitor operation. However, the unit will perform satisfactorily if horizontal mounting is necessary.

The constant-voltage transformer depends upon natural draft air circulation for adequate cooling. It should not be mounted in confined or enclosed spaces unless special provisions have been made for ventilation. In operation, a temperature rise will occur whether the transformer is or is not serving a load. Therefore, it is recommended that provisions be made for a line switch to disconnect power to the constant-voltage transformer when the unit is inoperative.

II-3. EQUIPMENT CABLING.

Before operating the equipment, check the power supply and terminations of the interconnecting cables as specified in the following paragraphs.

a. Power Supply. The Model PS-8b requires 118 volts, 50 - 60 cycles for proper operation. In order to deliver a stable supply of this power requirement, a constant-voltage transformer is supplied and must be used as the power supply input at all times.

CAUTION

1. Do not use the constant-voltage transformer to supply line power to auxiliary or additional equipment together with the Panoramic equipment.
2. For satisfactory operation, the constant-voltage transformer must be used within the input voltage and frequency limits specified on its nameplate.

A constant-voltage transformer, operating within one of the four following voltage-frequency combinations is supplied, as requested by the customer's purchase order.

	Input Voltage	Frequency
1.	95 - 130 V	60 cps
2.	95 - 130 V	50 cps
3.	195 - 250 V	60 cps
4.	195 - 250 V	50 cps

b. Cable Connections. The Panalyzor is normally shipped with all the interconnecting cables, except those of the constant-voltage transformer already installed. Be sure that all plugs and connectors are securely seated. Table II-1 lists cables supplied with the equipment and their interconnecting points. See Figure II-1 for connector identification.

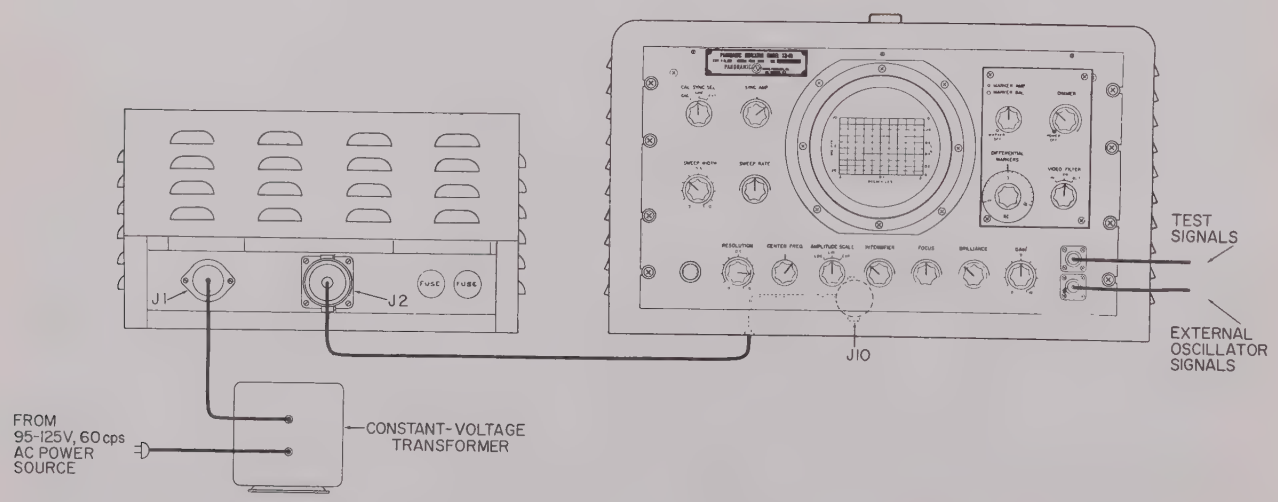


Figure II-1. Interconnecting Diagram.

Table II-1. Cabling Connections

Cable	From	To
14 wire interconnecting power cable W3046	J10, rear of Panalyzor chassis	J2, rear of power supply chassis
3 wire power cable w/female plug	Constant-voltage transformer	J1, rear of power supply chassis
3 wire power cable w/male plug	Constant-voltage transformer	Appropriate a-c power source
Coaxial cable w/1 type N connector	J101, front of Panalyzor chassis	Test signals
Coaxial cable w/1 type N connector	J102, front of Panalyzor chassis	Output of external signal source

II-4. PRELIMINARY ADJUSTMENTS AND CHECKS.

A logical sequence of adjustments and checks of front panel and chassis controls is described in the following paragraphs. Should any of the checks fail to produce the indicated results, refer to CHAPTER V - SERVICE AND MAINTENANCE.

a. Application of Power. Turn power on with DIMMER control. The pilot light should go on immediately. When the crt is a type 5ADP7, clockwise rotation of DIMMER control increases brightness of crt screen edge lighting. When a type 5UP7 crt is supplied, clockwise rotation of DIMMER control dims the pilot light. Set BRILLIANCE control between one-half and two-thirds of maximum clockwise position. The baseline trace should appear within five minutes.

b. Panalyzor Adjustments and Checks. Checks and adjustments for the Panalyzor are listed below. To perform these checks, disconnect r-f cables from J101 and J102 and apply a calibrated 30-megacycle signal to connector J101.

1. FOCUS. Turn FOCUS control through its entire range. The trace should change from blurred to sharp to blurred. Set control at the sharp trace position for optimum viewing.

2. BRILLIANCE. Turn BRILLIANCE control through its entire range. The intensity should vary; at full counterclockwise position the baseline is off,

at full clockwise position the baseline is at its brightest. Normally, varying this control will also vary focus. Adjust both controls to obtain a sharp, bright trace.

3. GAIN. Clockwise rotation of GAIN control increases the gain of the amplifiers. To measure gain, turn CAL-SYNC SEL control to LINE, RESOLUTION and SWEEP WIDTH controls fully clockwise, and AMPLITUDE SCALE control to LIN. Inject a calibrated 30-megacycle signal of 750 microvolts into input jack, J101, and turn GAIN control fully clockwise. The signal pip should reach full scale height.

4. INTENSIFIER. Set INTENSIFIER control at its maximum counterclockwise position. Turn GAIN, RESOLUTION and SWEEP WIDTH controls completely clockwise. Noise peaks may appear on the screen. Rotate GAIN control counterclockwise until the noise level deflection is 1/4 inch. Adjust input signal for full scale deflection. Turn BRILLIANCE control counterclockwise until the deflections almost fade out. Turn INTENSIFIER clockwise. The noise lines and signals will brighten but the baseline will not be present.

5. SWEEP RATE and SYNC AMP. Set CAL-SYNC SEL control to CAL. If necessary, reduce amplitude of signal. Turn SYNC AMP control fully counterclockwise and SWEEP RATE control fully clockwise. As SWEEP RATE control is slowly turned counterclockwise, one cycle of the line frequency should appear. Slowly turn the SYNC AMP control until display is steadied. If the line frequency is 60 cps, the one cycle presentation will indicate a 60 cps sweep. Continue turning SWEEP RATE control counterclockwise for indications of 30 cps sweeps (2-cycle presentation), 20 cps sweeps (3-cycle presentation), and 15 cps sweeps (4-cycle presentation). The sweep rate at any position is equal to 60 cps divided by the number of cycles visible. A one-second sweep is reached near the maximum counterclockwise position of the rate control. At low rates, it is easier to count sweeps using a stop watch.

6. CENTER FREQ. Set center frequency signal near the approximate center of screen. Turn SWEEP WIDTH control fully counterclockwise. Adjust CENTER FREQ. control for maximum vertical deflection. Turn SWEEP WIDTH control to maximum. Pip should be located exactly in the center of baseline.

7. SWEEP WIDTH. Set front panel controls as outlined for CENTER FREQ. check. With SWEEP WIDTH control completely clockwise, vary the frequency of the input signal between 25 and 35 megacycles. When the upper and lower limit frequencies are applied, corresponding deflections should appear within one-half division of the horizontal calibration extremities scribed on the frequency sweep axis, indicating that the scanning width is within specifications.

8. RESOLUTION. Set the front-panel controls as outlined for CENTER FREQ. check. Apply a 30-megacycle signal and adjust GAIN control for full-scale deflection. Gradually reduce the scanning width using the SWEEP WIDTH control, until the pip base covers approximately one-third of the screen. Pip width should decrease when RESOLUTION control is turned counterclockwise, and a change in pip height may be noticed. Rotation through the full range of the RESOLUTION control may result in a major change in pip height. Small convolutions or ringing will appear on the trailing edge of the pip. Optimum resolution occurs when the first convolution beyond the apex of the pip dips into the baseline.

9. AMPLITUDE SCALE. Set the front-panel controls as outlined for the CENTER FREQ. check. Apply a 30-megacycle signal and adjust pip height for full-scale deflection. Switch to LOG position. The deflection should reduce to half scale (0 db). Increase the signal input by 10 times; the deflection should rise to full scale (+20 db).

10. CAL-SYNC SEL. For CAL position see step 5. In LINE position, note that an end of the trace line is visible. Set SWEEP RATE control for approximately 30 cps. Set SYNC AMP control at the maximum counterclockwise position. The end of the trace line will appear to jitter back and forth. Slowly advance the SYNC AMP control. At about one-quarter rotation, the trace line will remain stationary.

In the EXT position apply 60 cps from the secondary of a filament transformer (or from any other available 5 to 15 volt supply at the line frequency) to the Ext Sync jack on the Panalyzor. Repeat check as in LINE position.

11. VIDEO FILTER. When the VIDEO FILTER is switched to LOW position, noise on the screen is filtered, and signal pips are integrated and shifted slightly. Greater effects are noticed with the switch in HIGH position.

The switch position (LOW or HIGH) is selected to give the clearest picture with minimum loss of amplitude. Sweep rate will have some effect on the resultant picture. Fast sweep rates will degrade the picture beyond use.

12. MARKER AMP. Set the front-panel controls as outlined in the CENTER FREQ. check, and set SWEEP WIDTH control to 1.0. Clockwise rotation of MARKER AMP control increases the amplitude of the markers. To avoid spurious marker pips, adjust the control for a pip height of full scale on LIN and no more than one-half scale on LOG. When the equipment is in use, the MARKER AMP control is set at the discretion of the operator.

13. MARKER BALANCE. Set DIFFERENTIAL MARKERS dial to 5. Two side marker pips and one center marker pip will appear on the baseline. Rotate the MARKER BAL control through its range. When the side markers are at equal amplitudes, MARKER BAL control is set properly.

14. DIFFERENTIAL MARKERS. When DIFFERENTIAL MARKERS dial is on 0 position, one marker pip will appear at the center of the baseline. As the dial is turned toward 10, two pips will separate from the center and move toward the ends of the baseline. A smaller pip will remain stationary at the center mark. When DIFFERENTIAL MARKERS dial reaches 10, the two side markers will reach the maximum point of screen calibration. These points should coincide with the SWEEP WIDTH checks made in step 10. Return dial to 0. The two side markers will converge on the center marker pip and a zero beat indication will result.

CHAPTER III - OPERATION

III-1. GENERAL OPERATION.

The general operation of Panoramic Panalyzor, Model SB-8b, is described in this chapter. Before operating the equipment, be sure the adjustments and checks listed in Section II-4 have been completed. To operate the equipment, proceed as follows.

a. Turn power on with DIMMER control. Allow five minutes warm-up time for the baseline to appear on the screen.

b. When baseline appears, set front-panel controls to the following positions.

Control	Position
CENTER FREQ.	on vertical marker
SWEEP WIDTH	fully clockwise
RESOLUTION	fully clockwise
BRILLIANCE	to desired brightness
INTENSIFIER	fully counterclockwise
FOCUS	to sharpest trace
AMPLITUDE SCALE	LIN
GAIN	approximately 3/4 maximum
SWEEP RATE	30 cycles
VIDEO FILTER	OUT
CAL-SYNC SEL	LINE
SYNC AMP	clockwise until sweep is locked

c. Apply both inputs to jacks J101 and J102 on the Panalyzor.

d. Operate Panalyzor at maximum gain. When on signal, GAIN control can be rotated clockwise to reduce amplitude.

e. To determine absolute frequencies precisely, an absorption type wavemeter should be inserted between the signal source and the signal input. Tune the wavemeter through its range. When the signal pip disappears from the screen or decreases to minimum, the wavemeter indicates signal frequency.

III-2. RELATIVE AMPLITUDE MEASUREMENTS.

Relative heights of pip deflections on the crt screen are proportional to relative amplitudes of frequency components being analyzed within the limits of flatness of response. To observe signals of comparative amplitude, AMPLITUDE SCALE control should be set to LIN position. The LIN scale of the crt screen is calibrated into ten divisions, with indices on the right side of the screen.

Examination of signals of wide divergence in amplitude will require the LOG setting of the scale control. In this position, the calibration range is from +20 db to -20 db, in 5 db steps, as indicated by calibration dots on the left side of the crt screen. Circuit time constants do not allow the LOG feature to function properly with narrow pulses.

In EXP position, pip deflection height is proportional to the square of the voltage (power) of the frequency component. Thus, differences in amplitude will be accented for closer evaluation. This accenting will improve signal-to-noise ratio on the screen. Additional improvement of signal-to-noise ratio can be obtained with the VIDEO FILTER control. The EXP feature is accurate only when comparing pip heights above 1/4 scale deflection.

III-3. OPERATION WITH DIFFERENTIAL MARKERS.

The following procedure describes the operation of equipment with differential markers displayed.

a. Engage marker circuit by turning MARKER AMP control clockwise. Continue clockwise rotation until marker pips are half-to full-scale height. If operated for full scale on log amplitude, spurious pips will appear, therefore, it is important not to exceed half scale when set to LOG position.

b. Adjust MARKER BAL control to equalize heights of marker pips.

c. Distance between two markers is varied with DIFFERENTIAL MARKERS tuning control, and sweep width is read directly from the calibrated dial. If the frequency separation of the markers is greater than the sweep width, marker pips will not appear on the screen. Increasing sweep width will return marker pips.

III-4. NARROW BAND ANALYSIS.

At full sweep width deflections of test signals, or carriers and sidebands, having small frequency differences, tend to merge. These deflections may be separated (resolved) by reducing sweep width, or narrowing i-f bandwidth, as listed below.

a. Set RESOLUTION control completely clockwise for broadest i-f bandwidth.

b. Tune desired band of signals to center of the screen.

c. Spread band of signals across the screen by turning SWEEP WIDTH control counterclockwise. Note that at reduced sweep width each screen calibration mark represents a frequency separation of one-tenth sweep width. Keep the band centered with the CENTER FREQ. control.

d. Turn RESOLUTION control counterclockwise until individual signals are clearly resolved. If signals do not resolve, a slower sweep rate must be used. Best resolution can be recognized by the nature of ringing pulses appearing on the trailing edge of the signal pip. See Figure III-1. Ringing can be seen more easily with the VIDEO FILTER control in the OUT position. Rotation of the RESOLUTION control affects pip amplitude. Reset amplitude with GAIN control. Rotating the RESOLUTION control past the print where best resolution is reached will decrease resolving power and greatly reduce sensitivity.

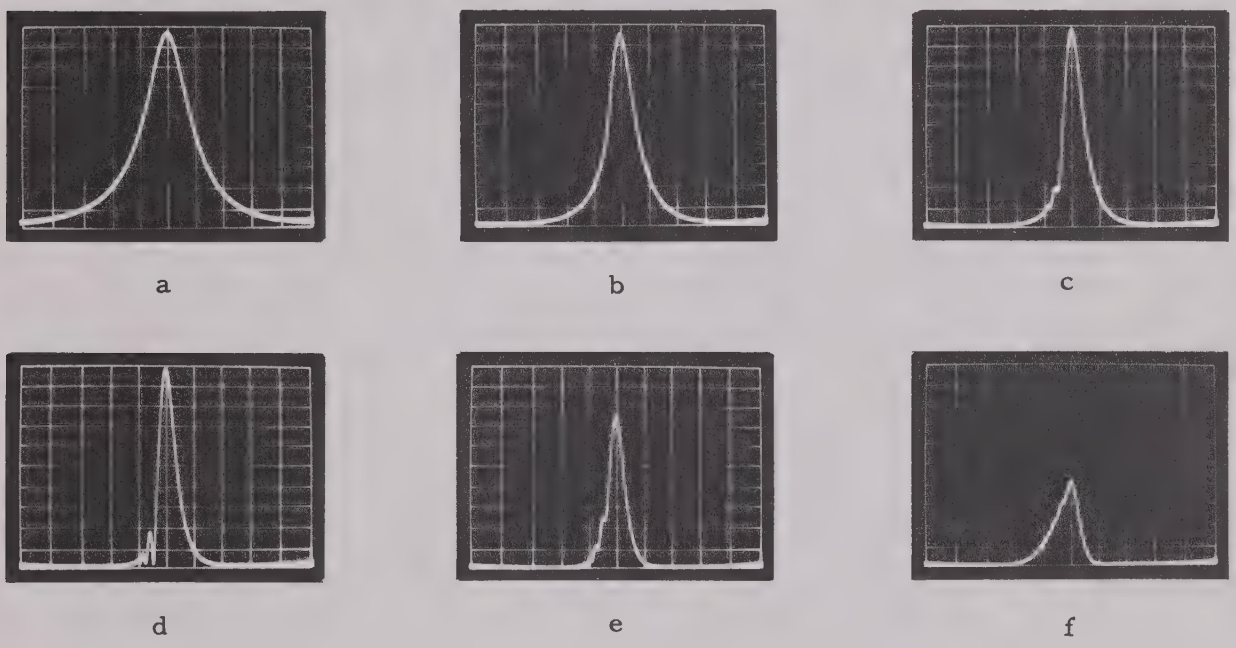


Figure III-1. Ringing as an Indication of Optimum Resolution.

The waveforms of Figure III-1 indicate the progressive variations in pip shapes caused by rotation of the RESOLUTION control. In (a) and (b), i-f bandwidth is broad. As the control is rotated, ringing of the signal occurs as shown in (c).

The extent of ringing in (d) shows the best possible resolution. At this point the notch between the signal pip and nearest ringing pip extends into the baseline. As the i-f bandwidth is narrowed further, excessive ringing widens the signal pip, decreases pip amplitude, and effectively reduces the resolving power. Further rotation of the RESOLUTION control causes a reduction in amplitude and remerging of pips as shown in (e) and (f).

Figure III-2 is a nomograph for determining the relationship between resolution and sweep width at sweep rates of 0.1 to 100 cps. It is used for

determining the best possible resolution for any given combination of sweep width and sweep rate. The figures given in the nomograph apply only within the limits specified for sweep width, sweep rates and resolution range in Section I-5. ELECTRICAL CHARACTERISTICS.

For a given setting of the SWEEP WIDTH control, and for any one sweep rate, there is a setting of the RESOLUTION control which will produce the best resolution. The following example illustrates how the resolution nomograph is used.

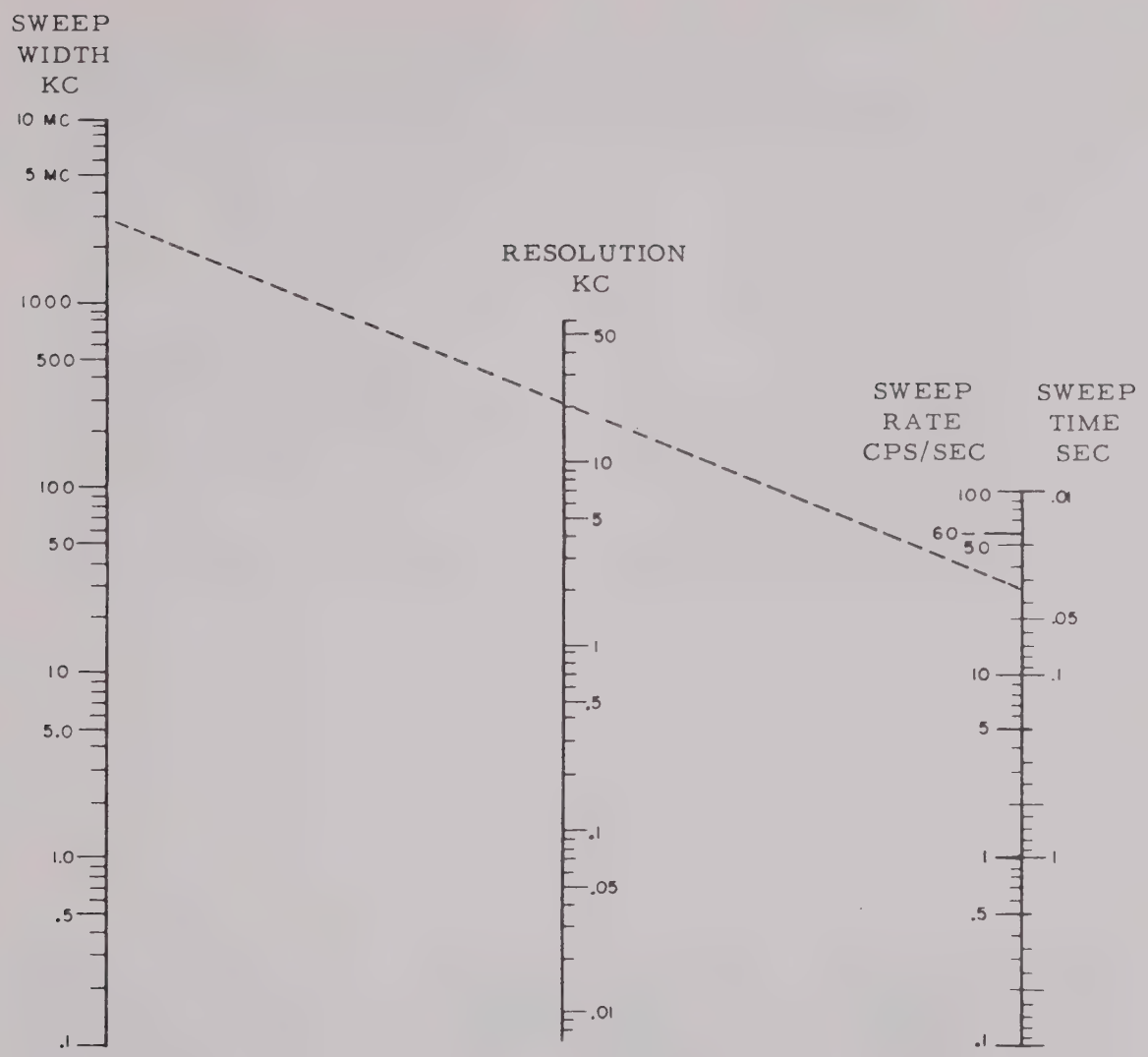
Assume that two signals of equal amplitude, 20 kilocycles apart, are to be observed. At a sweep rate of 30 cps, a sweep width of 3 megacycles or less must be used to resolve 20 kilocycles, as indicated by the dashed line.

If a signal of small amplitude is close in frequency to a signal of large amplitude, the pip representing the small amplitude signal will be influenced by the large amplitude signal (the amplitude-versus-frequency response of the i-f section being bell-shaped). As the signals are separated in frequency, the error becomes less. The minimum frequency separation required to measure amplitude ratios E_2/E_1 for the equipment can be determined from Figure III-3.

If adjacent signals have a large amplitude difference, RESOLUTION control settings which depict the signals as definitely separated pips should be used. Waveforms (a) through (f) of Figure III-4 illustrate the progressive variation in pip separation of two signals as the RESOLUTION control is rotated in a counterclockwise direction. In these illustrations sweep width = 500 KC, frequency separation = 50 KC, sweep rate = 30 cps, E_2/E_1 = 12 db.

In (a) i-f bandwidth is broad. In (b) and (c) the smaller pip begins to emerge as bandwidth is narrowed. In (d) definite separation of pips is seen. However, due to beating of the two signals, the amplitude indication of the smaller pip is higher than its final value. In (e), beginning of ringing on the left side of the large pip shows i-f bandwidth approaching an optimum value. The extent of ringing in (f) shows that optimum i-f bandwidth has been reached. Highest accuracy of relative amplitude measurements results when adjacent signals are completely resolved.

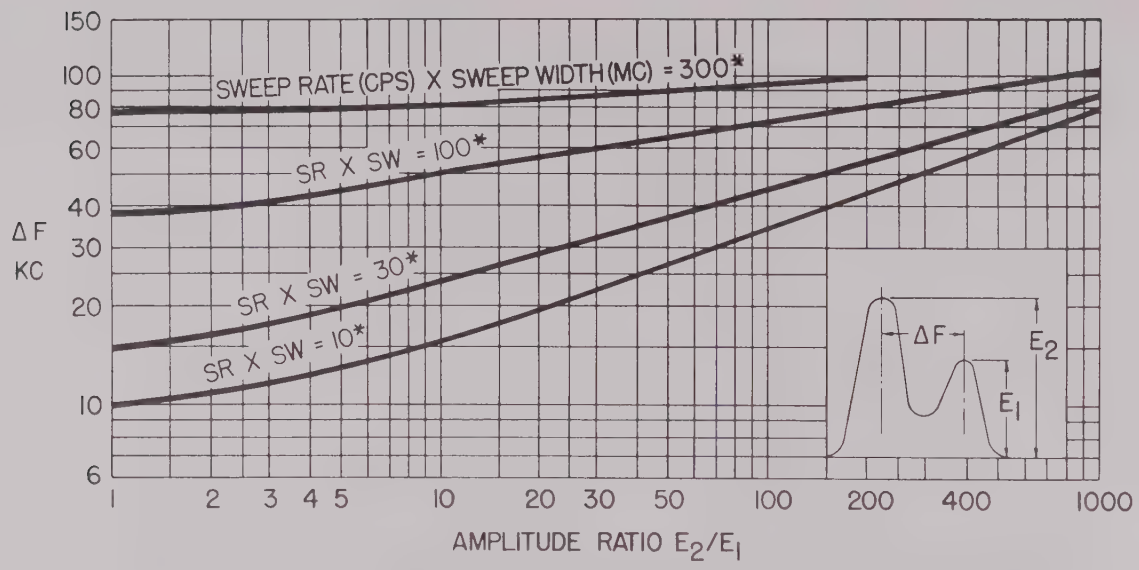
To obtain greater resolution by increasing the scanning time, lower sweep rate by rotating SWEEP RATE control counterclockwise. Readjust SYNC AMP control to keep the sweep in synchronism. To better separate the signals, SWEEP WIDTH and RESOLUTION controls can be rotated further counterclockwise and the SWEEP RATE control set for a slower rate.



NOTE

Portions of this nomograph which are usable for the analyzer covered by this Instruction Manual are listed under maximum sweep width, sweep rates and resolution in section I-5. ELECTRICAL CHARACTERISTICS.

Figure III-2. Resolution Nomograph.



*1. SCANNING VELOCITY = SWEEP RATE (SR) IN SWEEPS/SEC X SWEEP WIDTH (SW) IN MC/SEC/SWEEP = MC/SEC^2

2. ALL READINGS TAKEN AT OPTIMUM RESOLUTION FOR EACH SCANNING VELOCITY

Figure III-3. Minimum Frequency Separation ΔF (KC) Required to Measure Amplitude Ratios E_2/E_1.

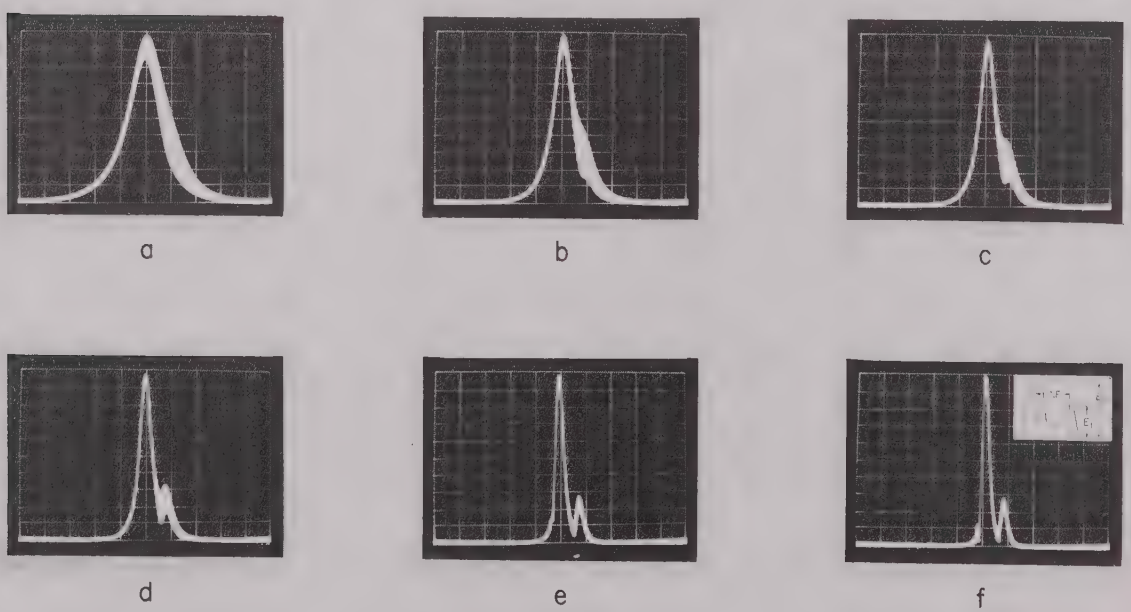
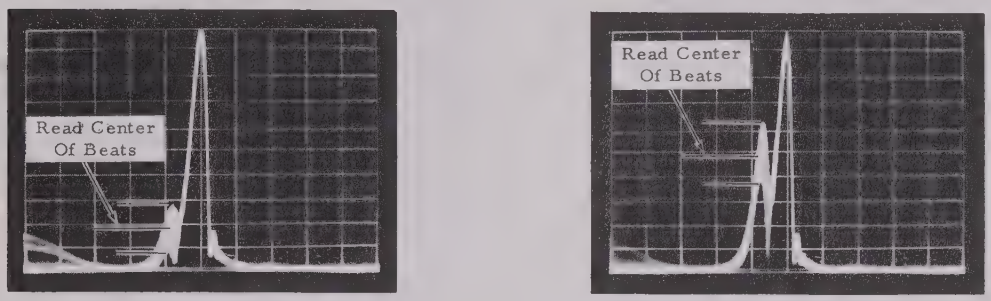


Figure III-4. Resolution of Signals of Unequal Amplitude.

If mandatory to observe a given bandwidth at one time, with the contained signals closely spaced, best possible resolution is indicated by the clearest picture. A reasonably accurate measurement of relative amplitudes can be made by reading the center of the beats. This is illustrated in Figure III-5. The amplitude ratio in (a) is greater than the ratio in (b), resulting in a somewhat different presentation.



a b

Figure III-5. Measurement of Closely Spaced Unequal Amplitude Signals.

After the clearest picture has been attained, further counterclockwise rotation of the RESOLUTION control will result in lessened resolution and bobbing presentations.

III-5. OPERATING PROCEDURE FOR PULSED SIGNALS.

Pulsed signals as displayed on the screen are composed of a series of deflections of relatively short duration. Therefore, a peak produced by one of these pulses traverses the screen so rapidly that the crt screen is insufficiently excited to produce a visible trace. Turning up BRILLIANCE control does not help because increased brightness tends to wash out the pulse pattern. To overcome this situation, use INTENSIFIER control as outlined below.

a. Follow regular operating procedure.

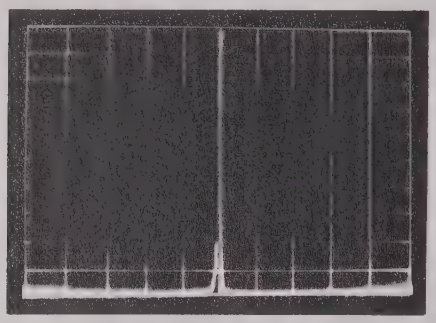
b. Reduce intensity of baseline trace until barely visible.

c. Turn INTENSIFIER control clockwise. The pulse peaks should come into view while the baseline is not equally apparent. If necessary, use FOCUS control.

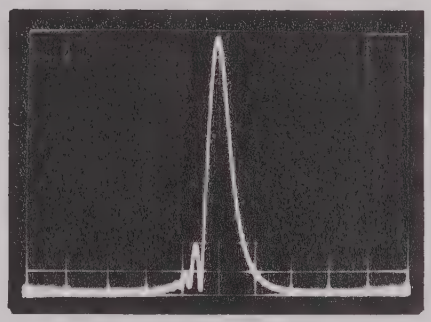
III-6. INTERPRETATION OF SIGNALS.

With a little experience, the operator will be able to recognize the visual appearance of the following various types of signals.

a. A constant carrier appears as a deflection of fixed height; see Figure III-6 (a) and (b).



(a) Constant carrier signal at approximately maximum sweep width.

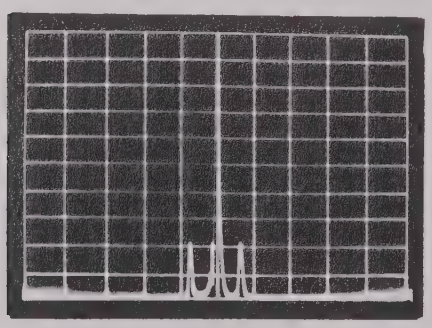


(b) Appearance of constant carrier at reduced sweep width.

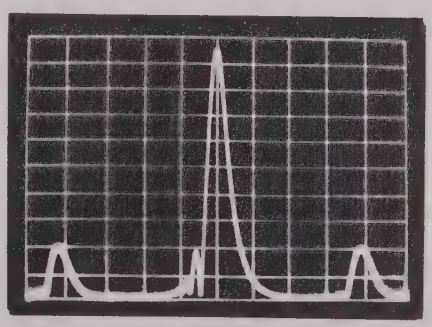
Figure III-6. Constant Carrier Presentation.

b. An amplitude-modulated carrier appears as a deflection of variable height. Non-constant tone modulation of low frequency will produce a series of convolutions varying in height, their number being determined by the modulation frequency. The nature of the presentation will depend upon the sweep width; see Figure III-7 (a) and (b).

As the modulation frequency increases, convolutions move toward the two sides of the deflection, and sidebands tend to become visible. It becomes possible to separate sidebands by reducing sweep width of the Panalyzor. The RESOLUTION control will enable further separation. Higher-frequency modulation causes the bands to move away from the center deflections.



(a) A-m signal, showing carrier and two sidebands.

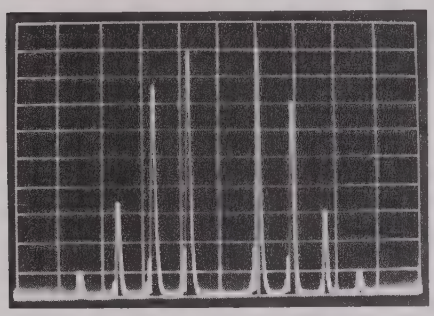


(b) Same a-m signal at reduced sweep width, carrier remains at center of screen.

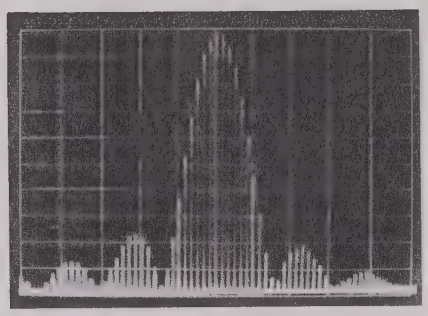
Figure III-7. A-m Signal Presentations.

Because of possible non-linear amplification of the Model SB-8b over a wide-band, equal strength sidebands may appear unequal in height. Their relative heights may change as frequency is varied and the deflection moves across the screen.

c. Frequency-modulated carriers and pulsed r-f signals appear as shown on Figure III-8 (a) and (b).



(a) Frequency distribution of an f-m signal at carrier null.



(b) Spikes indicating distribution of a pulsed r-f signal.

Figure III-8. F-m and Pulsed R-f Signals.

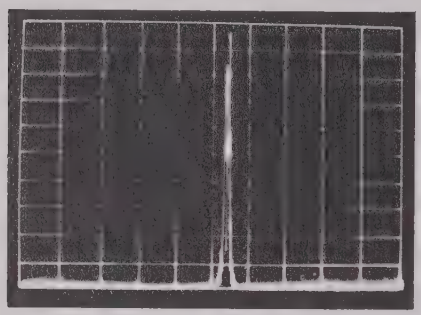
d. A carrier frequency modulated at low rate appears as a wobbling pip.

e. C-w signals appear and disappear in step with the keying of the signal source. During moments when the signal is off, the frequency sweep axis is closed at the base of the signal. In very rapidly keyed signals the deflection and the baseline are seen simultaneously. Mcw signals appear as c-w signals of varying heights. If the modulation rate is high, sidebands will appear.

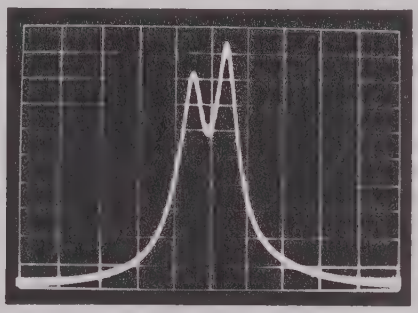
f. Signal Interference. Two signals, so close in frequency as to cause interference (beats), may appear on the screen as a single deflection, varying in height, see Figure III-9 (a). As the frequency separation is increased, the deflection appears as if modulated on one side only. Further increase of frequency will cause a break in the apex of the deflection, see Figure III-9 (b). By reducing the sweep width of the Panalyzor, the respective deflections will gradually separate. Further separation is effected using the RESOLUTION control and setting SWEEP RATE lower. Single sideband modulation appears as two carriers of slightly different frequency.

g. Transient Disturbances. Periodic transients, produced by motors, vibrators, buzzers, etc., appear as signals moving along the frequency-sweep baseline. An accelerating engine will produce a set of deflections which may move first in one direction, slow down, stop, and then move in the opposite direction.

This is caused by the Panalyzor sweeping at a fixed rate, and the transient occurring at a variable rate. The images stand still when there is synchronism between the two. If the transient disturbance is synchronized with a 60-cycle line, noise appears as a fixed signal varying in height as the frequency is tuned. Such deflections may appear to be a-m signals or steady carriers. Aperiodic transients, as static, appear as irregular deflections and flash along the whole frequency sweep axis.



(a) Two interfering signals at maximum sweep width.



(b) Same signals at reduced sweep width, resulting in improved separation or resolution.

Figure III-9. Resolution of Interfering Signals.

h. Images are distinguishable from normal signals, because they move in an opposite direction with respect to normal signals as the frequency is varied.

i. Harmonics produced in the mixer by beating very strong signals with harmonics of the oscillator, will be distinguishable from other signals because they move across the screen more rapidly than normal signals. A second harmonic spurious signal will move across the screen at double the normal signal speed. Generally a reduction in signal strength will eliminate this type of spurious signal.

j. Apparatus using an unfiltered or a-c power supply, will produce periodic disturbances causing intermittent deflections to appear. These disturbances are caused by the equipment emitting signals pulsating in synchronism with the power line. The Panalyzor, while sweeping the spectrum, is also in synchronism with the line, but at a lower frequency. When certain phase relationships exist, the Panalyzor receives the periodic disturbances.

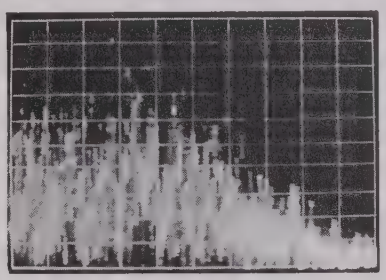
To examine signals synchronized to line frequency, set CAL-SYNC SEL control to LINE, SYNC AMP control fully counterclockwise, and adjust SWEEP RATE control for the best presentation across the entire screen. This provides the asynchronous operation necessary to see the entire signal. The SYNC AMP control can provide synchronism to lock in an interesting portion of the display.

k. Spurious Signals. If signal strength exceeds a certain value, a deflection caused by any signal disperses into a series of parallel deflections, similar to sidebands. Attenuation of signal input level will remedy this situation.

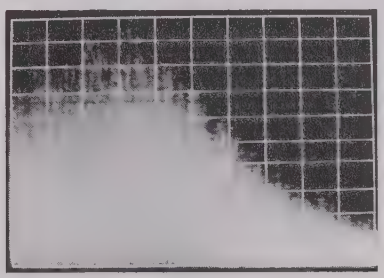
l. Noise Analysis. Noise or random signals are analyzed using the same general techniques used for discrete signals. Wide i-f bandwidths produce better noise envelope averaging and are preferred for general noise analysis. If the noise sources are selective, narrow i-f bandwidths are required, permitting noise characteristics to be presented in fine detail. When narrow bandwidths are used, low sweep rates should be set to allow a small change in rate without a noticeable change in amplitude. Narrow bandwidths increase equipment response to higher or lower than average noise amplitudes within the bandwidth.

If absolute noise measurements are required, a calibration of the Panalyzor using a known noise amplitude is necessary. The calibration must be made at the scanning velocity and i-f bandwidth to be used for measurement. In noise analysis, photographic averaging of noise level is accomplished by taking composite photographs of successive scan presentations.

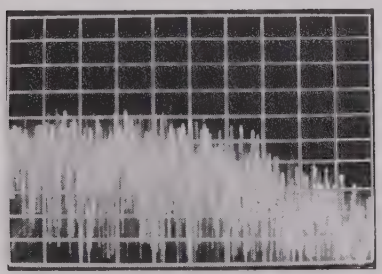
Typical screen presentations at different settings and photographic exposure times are shown in the following figures. Figure III-10(a) shows a single scan presentation of noise with the equipment set for narrow i-f bandwidth and LIN position. An extended photographic exposure of this presentation is shown in Figure III-10(b). The identical noise presentations using LOG position are shown in Figure III-10 (c) and (d).



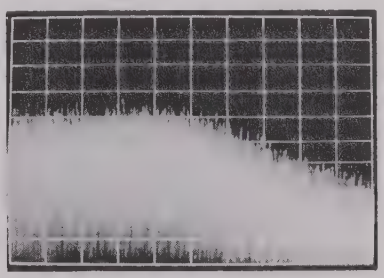
(a) LIN scale. Narrow i-f bandwidth.



(b) Same as (a) with extended photographic exposure.



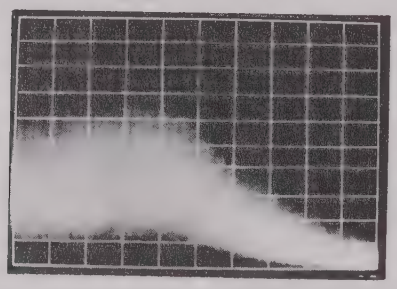
(c) Same as (a) using LOG amplitude scale.



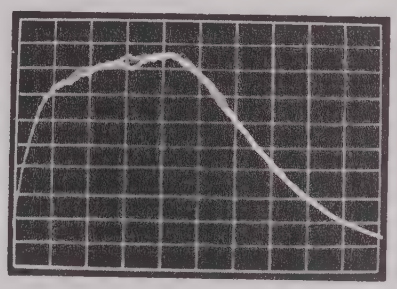
(d) Same as (c) with extended photographic exposure.

Figure III-10. Typical Screen Presentations of Noise Signals.

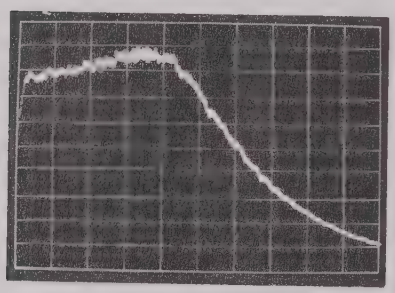
Wide bandwidths will provide a more typical display of noise amplitudes. A noise presentation using wide i-f bandwidth and LOG scale position is shown in Figure III-11 (a). Use of VIDEO FILTER control to obtain clearer noise spectra results in presentations shown in Figure III-11 (b) and (c). Markers may be used to define frequency points as shown in Figure III-11 (d).



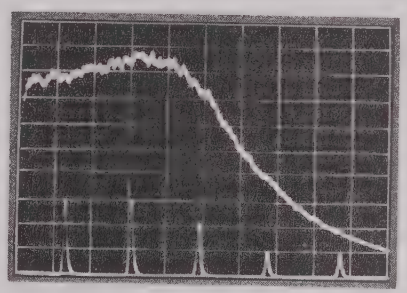
(a) LOG amplitude scale. Broad i-f bandwidth. One scan.



(b) Same as (a). Video filter used to obtain clear line presentation. Sweep rate too fast.



(c) Same as (b) with sweep rate adjusted for correct presentation.



(d) Same as (c) with marker presentation used to define frequency points (composite photo).

Figure III-11. Screen Presentations of Noise Signals Using Wide I-f Bandwidth and VIDEO FILTER.

CHAPTER IV - THEORY OF OPERATION

IV-1. INTRODUCTION.

Panalyzor, Model SB-8b, is basically an automatic scanning superheterodyne receiver providing a visual display of signals within a selected bandwidth. The equipment consists of an input mixer, a broadband r-f amplifier, a sweeping oscillator and mixer, a variable selectivity i-f amplifier and converter, a video amplifier with three modes of amplification, a signal intensifier circuit, associated sweep circuits, a cathode-ray tube indicator, and a power supply.

The frequency range of the equipment is limited by the limits of the external oscillator. A Model PS-8b power supply provides a regulated B+ voltage for all units; high voltage for crt operation, and filament voltage to the power supply. A block diagram of the Panalyzor is shown in Figure IV-1.

IV-2. BLOCK DIAGRAM ANALYSIS.

When a test signal is selected, it is applied along with the output of the external oscillator to the input mixer. If the optional preamplifier is used, the test signal and external oscillator signal must be applied to an external mixer. The 30-megacycle output of this external mixer is applied to the input of the preamplifier. The preamplifier output is consequently applied to either input jack of the Panalyzor. Because this is a 30-megacycle signal, it passes directly through the input mixer stage to the r-f amplifier.

The bandpass amplifier compensates for the selectivity of the external r-f and mixer stages and provides greater gain in the displayed band of frequencies. The r-f amplifier output is applied to the mixer stage where it is heterodyned with the sweeping oscillator output. Differential markers are also applied in the mixer stage.

The output of the mixer stage is applied to the first i-f stage, which is tuned to 23 megacycles, and consequently applied to the second i-f stage to produce the video frequency of 500 kilocycles. This signal is applied to the video amplifier section. A scale switch in this section permits a choice of amplitude presentation. The outputs of the video section are then applied to the cathode-ray tube for viewing. A detailed description of the equipment units is presented in the following paragraphs.

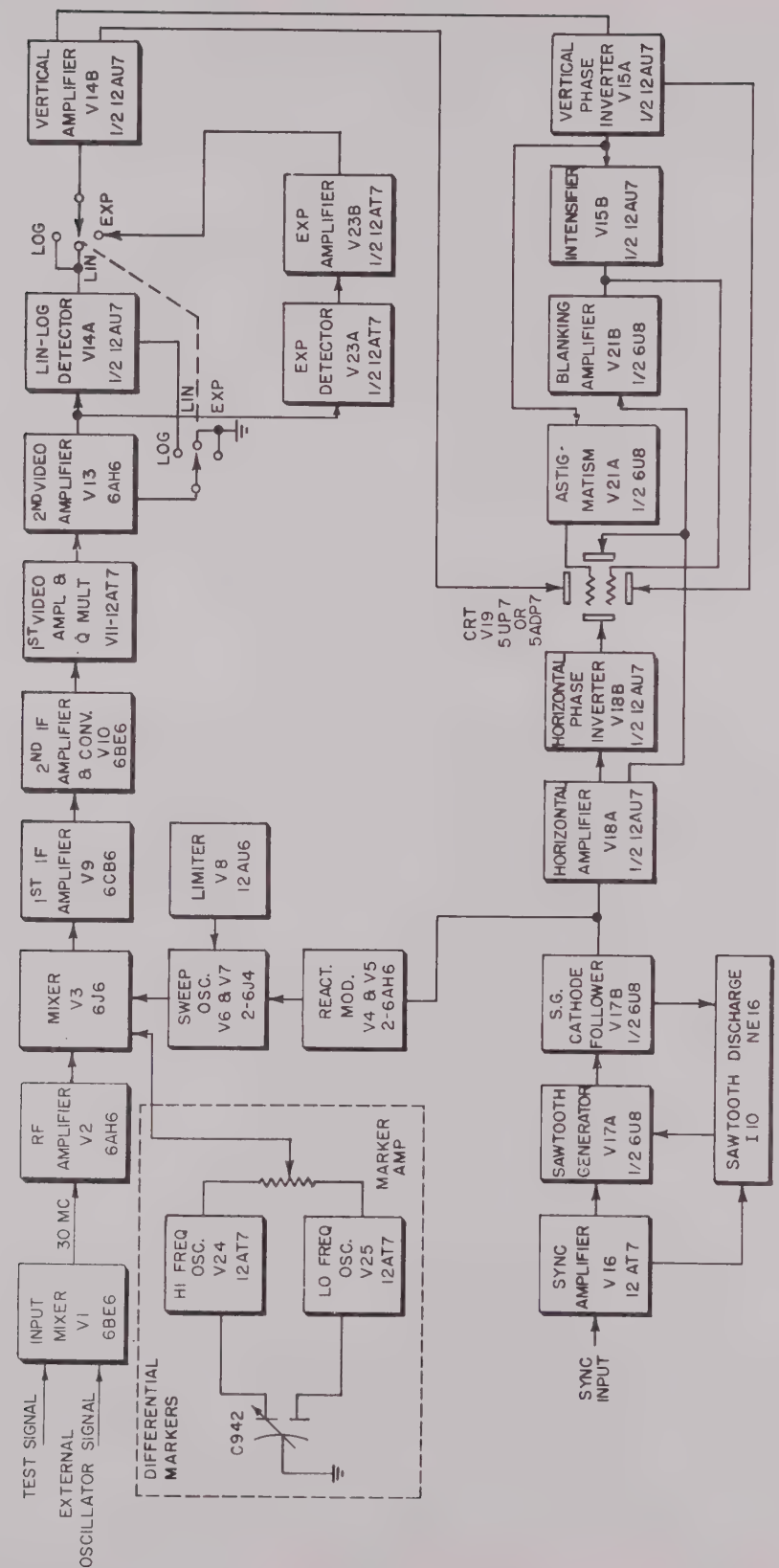

VERTICAL AMPLIFIER V14B 1/2 12AU7
LOG
LIN
EXP
LIN-LOG DETECTOR V14A 1/2 12AU7
EXP AMPLIFIER V23B 1/2 12AT7
EXP DETECTOR V23A 1/2 12AT7
2ND VIDEO AMPLIFIER V13 6AH6
1ST VIDEO AMPL & Q MULT V11-12AT7
2ND IF AMPLIFIER & CONV. V10 6BE6
1ST IF AMPLIFIER V9 6CB6
LIMITER V8 12AU6
MIXER V3 6J6
SWEEP OSC. V6 & V7 2-6J4
REACT. MOD. V4 & V5 2-6AH6
RF AMPLIFIER V2 6AH6
INPUT MIXER V1 6BE6
30 MC
TEST SIGNAL
EXTERNAL OSCILLATOR SIGNAL
DIFFERENTIAL MARKERS
HI FREQ OSC. V24 12AT7
LO FREQ OSC. V25 12AT7
C942
MARKER AMP
VERTICAL PHASE INVERTER V15A 1/2 12AU7
INTENSIFIER V15B 1/2 12AU7
BLANKING AMPLIFIER V21B 1/2 6U8
ASTIG-MATISM V21A 1/2 6U8
CRT V19 5UP7 OR 5ADP7
HORIZONTAL PHASE INVERTER V18B 1/2 12AU7
HORIZONTAL AMPLIFIER V18A 1/2 12AU7
S.G. CATHODE FOLLOWER V17B 1/2 6U8
SAWTOOTH GENERATOR V17A 1/2 6U8
SAWTOOTH DISCHARGE NE16
SYNC AMPLIFIER V16 12AT7
SYNC INPUT

Figure IV-1. Functional Block Diagram, Model SB-8b.

IV-3. DETAILED DESCRIPTION OF PREAMPLIFIER DA-1.

Preamplifier, DA-1, is offered as optional equipment to boost signal sensitivity of the Panalyzor. It is a broadband, stagger-tuned amplifier consisting of six tubes and associated circuitry and a power supply. An approximate 40 db sensitivity gain is obtained by incorporating this unit. A schematic diagram of the unit is shown in Figure IV-2.

a. Amplifier Circuit Description. Input signals are applied through impedance matching transformer L1 to the grid of tube V1, which is connected in a cascode arrangement with V2. Capacitor C2 and inductor L7 provide a low impedance ground return to the grid of V2. Peaked frequencies are applied to four following tuned-input amplifier stages V3, V4, V5, V6. Amplifier V3 is resonant to 25.4 megacycles, V4 to 28.1 megacycles, V5 to 31.9 megacycles and V6 to 34.6 megacycles. Signal output is applied through V6, a cathode follower stage with an output impedance of 50 ohms, to a step attenuator. From the attenuator the signal is applied to output jack J2.

b. Attenuator Circuit Description. When the test signal level is of the order of the standard sensitivity of the Panalyzor, the DA-1 should not be used. When using the DA-1 to amplify low level signals, the step attenuator is adjusted to obtain a suitable signal level into the Panalyzor and reduce the noise level. The attenuator provides 0 to 45 db of attenuation. There are four switches, providing 3 DB, 6 DB, 12 DB, and 24 DB attenuation. Other steps of attenuation are obtained by combining two or more switch positions, e.g., switches 24 DB and 6 DB are thrown to obtain 30 db of attenuation. With the GAIN control of the Panalyzor completely clockwise, the DA-1 attenuator is adjusted so that the maximum signal pip does not exceed full scale and noise on the screen is at an unobjectionable level. The GAIN control can be used as a fine gain adjust.

c. Power Supply Circuit Description. The power supply in the DA-1 consists of power transformer T1, rectifier tube V7, and associated tube circuitry. Power is applied to the power transformer primary when ON-OFF switch S1 is set to the ON position. Secondary windings of transformer T1 are color coded as indicated in Figure IV-2.

IV-4. DETAILED DESCRIPTION OF PANALYZOR, MODEL SB-8b.

Panalyzor, Model SB-8b, is an automatic scanning superheterodyne receiver with a fixed 30-megacycle r-f input frequency. It consists of an input mixer, a fixed-tuned broadband r-f amplifier, a reactance modulator, a sweeping-oscillator and mixer, variable selectivity i-f amplifiers, a detector, a video amplifier with selectable gain ratios, a cathode-ray tube indicator, associated sweep circuits and a signal intensifier circuit. A schematic diagram of the Panalyzor is located in the rear of this manual.

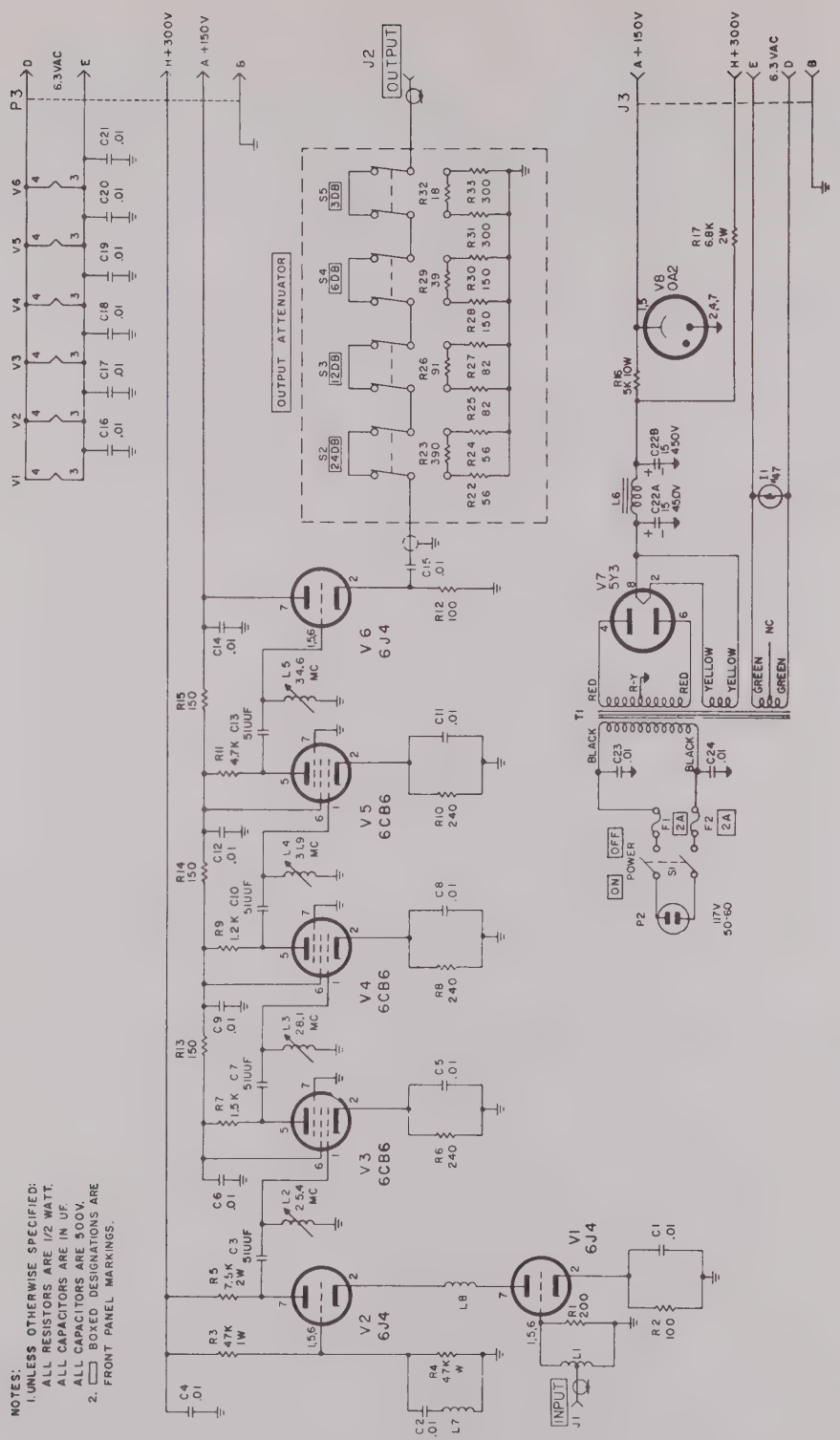


Figure IV-2. Schematic Diagram, Model DA-1.

Input signals are applied to an input mixer which produces a 30-megacycle output. This mixer output is amplified and applied to a second mixer with the progressively changing sweeping-oscillator output frequency. The resultant second mixer output is applied to the i-f section where an output proportional to the amplitude of the scanned signal is produced. This output is detected, amplified and applied to the vertical deflection plates of the crt.

a. R-f Circuit Description. Signals applied at input jacks J101 and J102 are applied to input mixer tube V1. The output of this tube is a 30-megacycle difference frequency which is applied to grid 1 of V2 through triple-tuned transformer T101. Resistor R806, connected to grid 1 of V2, loads T101 and determines broadness of frequency response in the r-f stage. The amplified output of V2 is applied through T102 to mixer stage V3. Plate tank circuits LA and LB are 23-megacycle traps, utilized to avoid spurious responses in the i-f stages. The resultant output of the r-f stage is a quadruple peaked response with peaks at 24.8, 28, 32, and 34.8 megacycles with an overall peak to valley ratio of ±15 percent as shown in Figure IV-3. GAIN potentiometer R703 controls variable grid bias in the r-f stage.

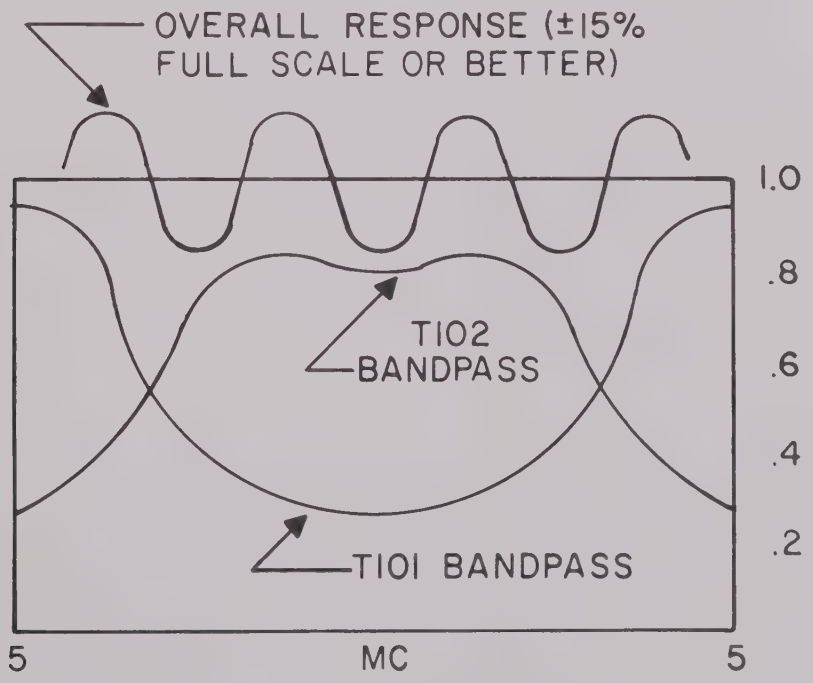


Figure IV-3. Resultant Output of R-f Stage.

b. Reactance Modulator Circuit Description. A controlled sawtooth voltage is applied to the grids of reactance tube modulator V4 and V5 producing two outputs of equal phase and amplitude. These outputs are applied to opposite ends of center-tapped oscillator coil Z101. Effectively, the reactance tubes act as a variable inductance shunted across Z101.

As the sawtooth voltage on the reactance modulator grids rises from maximum negative amplitude to maximum positive amplitude, tube conductance increases, changing phase angle of phase shifting networks R969 with C968 and R972 with C970. The phase angle shift is interpreted as a decrease of inductance shunting coil Z101, resulting in an increase of oscillator frequency.

The extent of frequency excursion is determined by the applied sawtooth amplitude. Variation of amplitude is accomplished with Sweep Limit screwdriver adjust R32, shown in Figure V-1 or SWEEP WIDTH control R33 on the front panel. When the applied sawtooth voltage is zero volts, the oscillator produces its mean frequency of 53 megacycles. By controlling reactor modulator bias, oscillator mean frequency becomes adjustable. CENTER FREQ control R977 is a fine cathode bias control and C.F. Pad R975 is a coarse bias adjustment used to restore or maintain oscillator mean frequency. To eliminate hum pick-up and isolate the modulator tubes from possible power supply fluctuations, d-c filament voltage and regulated plate voltage are utilized.

c. Oscillator Circuit Description. The sweep-oscillator circuit consists of modified push-pull connected triodes, V6 and V7, in conjunction with plate tank circuit Z101 and stray capacities. Cathodes of both tubes are r-f grounded, but receive a d-c bias voltage from center frequency controls R975 and R977. With zero voltage impressed across Z101, the oscillator circuit operates at its mean frequency of 53 megacycles. Coil Z101 is adjustable to compensate for mean frequency variation caused by component variations.

When the reactance modulator causes an inductance variation of coil Z101, oscillator output frequency varies accordingly. As the sawtooth voltage applied to the reactance modulator varies from maximum positive to maximum negative, the oscillator frequency varies proportionately from 58 megacycles to 48 megacycles. A constant voltage amplitude is maintained over the oscillator frequency range with limiter tube V8.

d. Limiter Circuit Description. Limiter stage V8 is an automatic regulator for oscillation amplitude over the entire Panalyzor frequency range. The r-f output of oscillator V6 is rectified with crystal diode CR960 and applied to grid 1 of V8 through resistor R962. With constant oscillator amplitude, d-c voltage level, at grid 1 of V8, is constant, and the tube remains in a steady state. Any spurious r-f is bypassed to ground through capacitors C963A and C961. If oscillation amplitude increases, V8 increases conduction and causes a greater voltage drop across plate resistor R961. This transient negative-going voltage is applied through C963B to the grids of V6 and V7, decreasing oscillator gain. The procedure reverses when oscillation amplitude decreases.

e. Differential Marker Circuit Description. The differential marker circuit consists of two grounded plate Hartley-type oscillators V24 and V25, which oscillate at mutually divergent frequencies from 15 megacycles. The resonant tank circuit at grid 2 of V24 varies in frequency from 15 to 17.5 megacycles as

the resonant tank circuit at grid 2 of V25 varies from 15 to 12.5 megacycles. This is accomplished with split-stator capacitor C942 connected common to both oscillator tank circuits. When both tank circuits are resonating at 15 megacycles, the surface area of the rotor is evenly divided between the stators. As the rotor is turned, capacity will decrease in the V24 tank circuit while increasing a proportional amount in the V25 tank circuit.

The outputs of both oscillators are applied through their respective interstage cathode followers to opposite ends of MARKER BAL potentiometer R945A, which enables the operator to adjust both marker oscillator signals to equal amplitude levels. These signals are then applied to the resistor network consisting of R951, R952 and potentiometer R945B. Varying R945B varies amplitude level of both marker oscillator signals.

The output of the marker oscillator circuit is coupled through capacitor C711 to grid 5 of mixer tube V3. Second harmonics of the marker oscillator frequencies mix with sweeping-oscillator output frequencies and appear as c-w signals on the crt. The ability to vary these pips with marker controls distinguishes them from bonafide signals.

If DIFFERENTIAL MARKERS control indicates 4, markers will be approximately 4 megacycles apart, equidistant from the baseline center. These markers at the 28- and 32- megacycle positions along the baseline represent second harmonics of the actual marker oscillator frequencies of 14 and 16 megacycles, respectively. Thus, at the marker oscillator frequency extremes of 12.5 and 17.5 megacycles, marker pips will appear on the baseline at the Panalyzor limits of 25 and 35 megacycles. When both marker oscillators are tuned to 15 megacycles, a single pip will appear at the center of the baseline. The sum frequency of the marker oscillators is always 30 megacycles; therefore, a small pip may appear at the center of the baseline when the MARKER AMP control is adjusted to produce high amplitude level markers.

Marker circuit filament voltages are applied when the equipment is energized. When plate voltage is applied to this circuit by closing switch S941, no warm-up delay is experienced, enabling accurate markers to appear on the crt instantaneously. Because operational design characteristics do not require marker pip accuracy greater than ±1 percent, large C constants in LC resonant tanks provide sufficient circuit stability.

f. Mixer Circuit Description. Mixer stage V3 utilizes a common cathode duotriode. Amplified signals from the r-f stages are applied to grid 5, biased by the network consisting of capacitors C812 and C813 and resistors R814, R815 and R823. Resistance value of R823 is selected to provide correct positive grid bias for optimum detection slope. Sweep-oscillator output is coupled into grid 6 through capacitor C927 and is also cathode coupled to the first half of the mixer. Marker inputs, when used, are connected to input jack J105 and are

applied at the junction of isolation resistor R813 and the biasing network. The mixer stage output is then applied to first i-f transformer Z102.

Assume amplified r-f signals applied to grid 5 are at frequencies of 25, 30 and 35 megacycles (see Figure IV-4). As the sweep-oscillator starts its upward frequency sweep from 48 to 58 megacycles, the instant 48 megacycle signal is applied to grid 6 for mixing, only the 25 megacycle signal will produce the necessary 23 megacycle difference frequency for application to i-f stage V9. Because oscillator sweep is coincident in time with horizontal deflection, the 25 megacycle signal will appear at the calibrated right hand limit of the baseline. At oscillator mean frequency of 53 megacycles the 30 megacycle input signal will produce a 23 megacycle difference frequency and coincidently appear at the baseline center. Similarly, the 35 megacycle signal will appear at the calibrated left-hand baseline limit when the oscillator frequency reaches its maximum frequency of 58 megacycles.

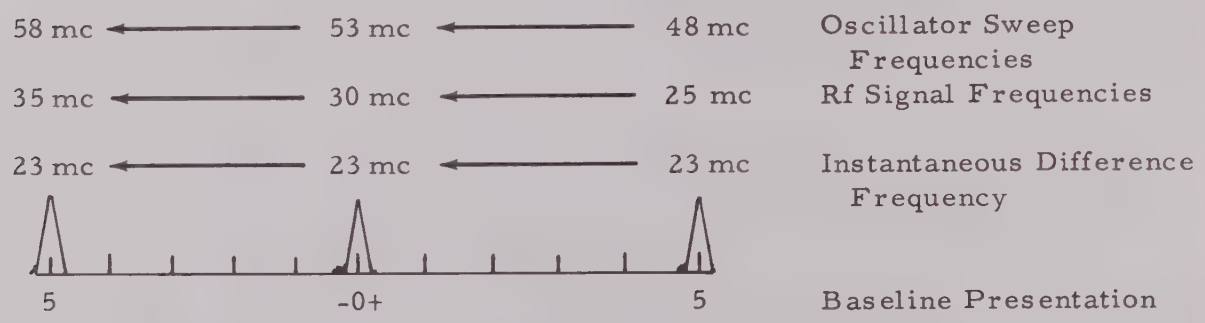


Figure IV-4. Relationship of R-f Signal Frequencies and Oscillator Sweep Frequencies.

g. I-f Circuit Description. The i-f section consists of amplifier stage V9, converter stage V10, transformers Z102, Z103, oscillator circuit Z104 and plate tank Z105. Mixer output signals of 23 megacycles are applied through i-f transformer Z102 and resistor R900 to grid 1 of V9. After amplification they are applied through i-f transformer Z103 to grid 7 of converter V10. Circuit response width is made narrow for increased selectivity. I-f gain potentiometer R904 in the cathode circuit controls minimum gain level for the equipment.

Tube V10 is a pentagrid converter serving as the 2nd i-f amplifier and an oscillator-mixer. Cathode tank circuit Z104 oscillates at 22.5 megacycles. This frequency signal is applied to grid 1 of V10, where it mixes with the 23 megacycle signal at grid 7. The output difference frequency of 500 kilocycles is applied to tuned plate coil Z105 for greater selectivity before application to the video amplifier section.

h. Video Amplifier Circuit Description. The video amplifier section includes variable resolution stage V11, video amplifier V13, lin-log detector and vertical amplifier V14, exponential detector and amplifier V23, and switching circuitry to provide either linear, logarithmic or exponential sweep magnitudes.

1. Variable Resolution Stage V11. Video outputs from tuned plate coil Z105 are coupled through RESOLUTION potentiometer R910A to transformer Z106. The transformer primary is connected to grid 2 of V11; the secondary output is coupled through capacitor C912 and potentiometer R910B to cathode 3. Although the circuit is regenerative, loading provided by potentiometer R910 prevents oscillating.

When test signals merge, it is necessary to resolve these signals for analyzation. Resolution depends on three factors; video bandwidth, sweep rate, and sweep width. Controlling these factors with the RESOLUTION, SWEEP RATE, and SWEEP WIDTH front-panel controls enables the operator to select an optimum resolution combination. Figure IV-5 represents resolution at a small sweep width and at a comparatively larger sweep width.

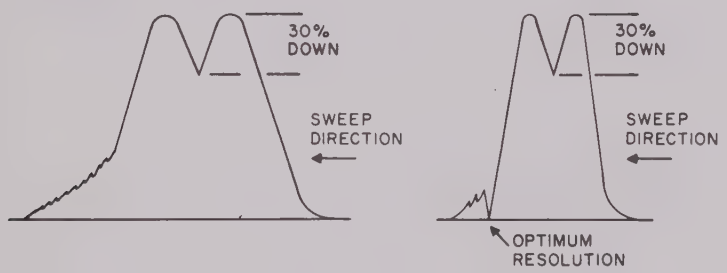


Figure IV-5. Indications of Resolution.

Optimum resolution results when the first ringing pulse at the signal trailing edge touches the baseline. To observe ringing effect, VIDEO FILTER control S13 must be switched to OUT position. To achieve optimum resolution at different sweep widths and rates, the video amplifier resolution must be varied. Variation of resolution is accomplished with three-section RESOLUTION potentiometer R910. Section A series loads transformer Z106 primary, and section B series loads transformer Z106 secondary. As loading of Z106 increases, Q decreases and, consequently, response width broadens. Narrow response is experienced as loading is decreased. With this method, response width can be varied from 9 to 85 kilocycles while section C of potentiometer R910 maintains circuit gain at a constant level.

2. Video Amplifier Stage. AMPLITUDE SCALE switch S10 allows selection of three types of signal amplification; linear, logarithmic, and exponential. Circuit operation in each position is described in the following paragraphs.

(a). LIN Position. In LIN position, grid resistor R918 is grounded and V13 is cathode biased, causing linear amplification. Screen grid resistor R928 aids linearity. The amplified output at plate 5 is applied to double-tuned plate tank Z103 resonant to 500 kilocycles. The primary of Z107 is decoupled from B+ fluctuations by capacitor C6C. The 500 kilocycle output from the secondary is directly applied to cathode 8 of lin-log detector V14.

(b). LOG Position. In LOG position, grid 1 of V13 is connected to ground through resistors R918, R920, and Log Scale adjust potentiometer R927. A portion of detected signal voltage is fed back as negative grid bias and is directly proportional to signal level. As signal level is increased, bias is increased, causing a decrease in tube gain. Therefore, higher level signals are amplified to a lesser degree than lower level signals. When viewed on the crt, these signals appear compressed. The extent of compression is determined by the setting of Log Scale adjust potentiometer R927. Shaping the plate current curve to conform with log zero position on the crt is aided by controlling screen bias with Log Zero adjust potentiometer R921. The output of V13 is applied through Z107 to cathode 8 of lin-log detector V14.

(c). EXP Position. In EXP position, grid 1 of V13 is connected to ground through resistor R918; screen grid resistor R924 is inserted; the output of low pass filter Z108 is removed from the circuit; and the output at plate 1 of V23 is applied to grid 2 of V14 through coupling capacitor C26 and switch S10C.

The output of V13 is applied through transformer Z107 and capacitor C916 to grid 7 of exponential detector and amplifier V23A. The output of V23A, tapped from cathode 8, is proportional to the square of input signal amplitude. It is applied to grid 2 of V23B through a 500-kilocycle trap consisting of coil L980 and capacitor C980 in series with resistor R72. The output of V23B at plate 1 is coupled through capacitor C26 to grid 2 of V14. D-c restorer CR2, in the grid circuit of V14, is incorporated to compensate for loss of d-c level.

3. Lin-Log Detector and Amplifier V14. Tube V14 is a duo-triode, with grid 7 and plate 6 of the first section connected to form a diode detector. In LIN or LOG position, rectified voltage appearing across load potentiometer R927 is coupled through low-pass filter Z108. Video frequencies are coupled through Z108 to grid 2 of V14. Cathode 3 is positive biased and supplies a back bias to cathode 8. This maintains the plate current slopes of both tube sections as near optimum as possible, regardless of signal amplitude.

High frequency components of narrow pulses are bypassed to ground when VIDEO FILTER switch S13 is turned to its HIGH or LOW position. In HIGH

position, capacitor C2 is connected to grid 2 and frequencies above 200 cps are bypassed. In LOW position, capacitor C3 is connected and frequencies above 2000 cps are bypassed. The equipment is normally used with switch S13 in OUT position and signals are viewed without distortion introduced by the video filter. The output at plate 1 is applied directly to vertical deflection plate 10 of the crt, and to grid 2 of V15 through the coupling network consisting of capacitor C4 and resistor R6.

i. Intensifier Circuit Description. Video signals from amplifier V14 are applied to grid 2 of V15. These signals produce an output at plate 1, 180 degrees out of phase, but equal to input signal amplitude and time of occurrence. As video signals from V14 are applied to vertical deflection plate 10 of the crt, equal but opposite signals produced by V15 are applied to vertical deflection plate 9. Vert. Pos. potentiometer R11 controls sweep position by varying d-c bias on cathode 3 of V15.

In LINE or EXT position, CAL-SYNC SEL switch S11B returns cathode resistor R9 to ground. In CAL position, a 6.3 volt, 60 cps signal is superimposed on cathode 3, and amplified. The amplified signal at plate 1 is applied to plate 10 of the crt, resulting in a 60 cps sinusoidal vertical deflection. The output of plate 1 is also coupled through resistor R7 and capacitor C5 to grid 7.

INTENSIFIER control R13 varies output magnitude by controlling bias on grid 7 of V15. Signals applied to grid 7 are amplified and capacitively coupled from plate 6 through capacitor C18 and resistor R56 to grid 2 of the crt. When BRILLIANCE control R53 is adjusted to cut off the crt beam, signals from the intensifier tube override bias and allow passage of the beam while simultaneously being applied to the vertical deflection plates. Intensifier tube V15 also increases signal peak intensities enabling them to be emphasized on the screen.

j. Astigmatism and Blanking Circuit Description. Tube V21 is a sharp-cut-off pentode that reduces trace defocusing and applies negative-going blanking pulses to the crt. Astig. control R61 sets bias on cathode 8 and is normally adjusted with intensifier tube grid 7 shorted to ground. In normal use, grid 9 of V21 and grid 7 of V15 receive the same signals. The output of V21 continually focuses the varying beam current caused by the coincident output of V15, thereby acting as an electronic focusing control.

A differential sawtooth voltage from horizontal amplifier V8 is applied to grid 2 of V21. This tube section produces a negative-going pulse that is simultaneously applied to control grid 2 of the crt and plate 6 of intensifier tube V15. During retrace time, this negative-going pulse blanks horizontal sweep and inhibits the output of V15.

k. Horizontal Sweep Circuit Description. The horizontal sweep circuit consists of sync generator V16, sweep generator V17, and sweep amplifier V18. A portion of the sweep generator output is fed back to reactance modulator tubes V4 and V5, causing them to modulate in synchronization with horizontal sweep.

1. Sync Amplifier V16. When CAL-SYNC SEL switch S11A is in CAL or LINE position, a 6.3 volt, 60 cps signal is applied through capacitor C7 and resistor R14 to grid 2 of V16. In EXT position sync voltage from an external source is applied through J103. A square wave output produced at plate 1 is coupled through capacitor C8 and resistor R19 to grid 7. Differentiated positive pulses of equal amplitudes are produced at plate 6 and applied through capacitor C9 and SYNC AMP potentiometer R22 to sweep oscillator discharge tube I10. Potentiometer R22 controls differentiated pulse magnitude. Lamp I10 is a modified NE-16, having an electrostatic coating. Voltage pulses from plate 6 of V16 change the firing level of I10 when applied to the electrostatic coating, causing the bulb to discharge sooner than if dependent on circuit time-constant parameters. This enables the sync pulse to determine sweep start. A type 47 pilot bulb, located near I10 maintains a level of ionization in the neon lamp through an illuminating action. This keep-alive action prevents erratic sweep circuit operation.

2. Sweep Generator V17. The sweep generator circuit consists of sharp-cutoff pentode V17, neon lamp I10 and a resistance-capacitance network consisting of resistor R23, dual potentiometer R24 and capacitor C12. The pentode section of V17 is connected as a Miller-type sweep-generator and the triode section is connected as a cathode follower.

When the equipment is energized, negative bias at grid 2 is sufficient to maintain the pentode section of V17 near cutoff, allowing voltage at plate 6 to increase. This positive-going voltage is applied to grid 9 of the cathode follower, increasing tube conduction. The steadily increasing voltage tapped from the junction of resistors R29 and R30 is fed back to grid 2, increasing the time constant of the circuit. When this steadily increasing voltage reaches the firing level of I10, the neon lamp conducts, causing capacitor C12 to discharge. As C12 discharges, grid 2 swings positive, increasing conduction and decreasing plate voltage to minimum potential. Bleed off time of the positive charge on grid 2 is determined by the r-c network. As grid 2 goes negative, the cycle repeats.

Section A of SWEEP RATE potentiometer R24 sets a negative level for grid 2; section B varies the r-c network time constant. Clockwise rotation of potentiometer R24 results in shorter time constants and proportional decreases in grid bias. The output of V17 is coupled from cathode 8 through capacitor C13, potentiometer R35 and resistor R34 to grid 2 of sweep amplifier V18.

3. Sweep Amplifier V18. Sawtooth signal amplitude applied to grid 2 of duo-triode V18 is adjusted with Line Size potentiometer R35; amplifier gain is adjusted with Sweep Limit potentiometer R32; and SWEEP WIDTH potentiometer R33 controls sawtooth signal magnitude applied to the junction of resistors R970 and R971 in the reactance oscillator circuit.

The output at plate 1 is applied directly to deflection plate 6 of the crt, through resistor R60 and capacitor C17 to grid 2 of blanking amplifier V21; and through resistor R45 to grid 7 of V18. The output at plate 6 is applied directly to plate 7 of the crt. Hor. Pos. potentiometer R43 in the cathode circuit sets d-c bias and governs d-c plate voltage level of the amplifier. Adjustment of this potentiometer determines the horizontal position of sweep presentation.

1. Cathode-Ray Tube Circuit Description. Two front-panel controls are provided for adjusting the crt beam. BRILLIANCE control R53 adjusts cathode bias, and FOCUS control R51 adjusts focusing anode voltage for sharpness of trace. A hum-bucking network consisting of capacitors C15, C29 and resistor R55 introduces out of phase voltages into the beam current to counteract a-c hum in the biasing circuits.

IV-5. DETAILED DESCRIPTION OF POWER SUPPLY PS-8b.

Power Supply, Model PS-8b, consists of power transformers T1 and T2, rectifier V101 and associated tube circuitry. Power is applied to the power transformer primaries when POWER-OFF DIMMER switch S12 is turned clockwise. Voltages mentioned in the following description are nominal. Power supply performance depends upon the input voltage supplied by the constant-voltage transformer.

The three secondary windings of transformer T1 are numbered as indicated on Figure IV-6. Leads 8 and 9 supply 6.3 volts ac through terminals M and P of connector J2. Leads 5 and 7 supply voltage to rectifier plates 4 and 6. These plates are connected to the high voltage secondary of T2 to prevent plate to cathode arcing within the tube. Leads 10 and 11 supply filament voltage to V101 at pins 2 and 8. Rectified voltage is tapped from pin 8 and applied to a filter network consisting of chokes L1 and L2, capacitors C1A and C1B, and bleeder resistor R1. The +300 volt dc output at the junction of R1 and L2 is applied to pin H of connector J2.

The three secondary windings of transformer T2 are numbered as indicated on Figure IV-6. Terminals 5 and 6 supply 6.3 volts ac to pins A and B of connector J2 for the crt filaments. The filaments are also connected to the -2000 volt dc supply to prevent cathode to filament arcing. Equipment high voltage is developed across terminals 7 and 9. This a-c voltage is applied to the junction of rectifiers CR1 and CR2. Through CR1 the voltage is applied to a filter circuit consisting of capacitors C2 and C3 and resistors R2, R3 and R4. A -2000-volt d-c potential is tapped from the junction of resistors

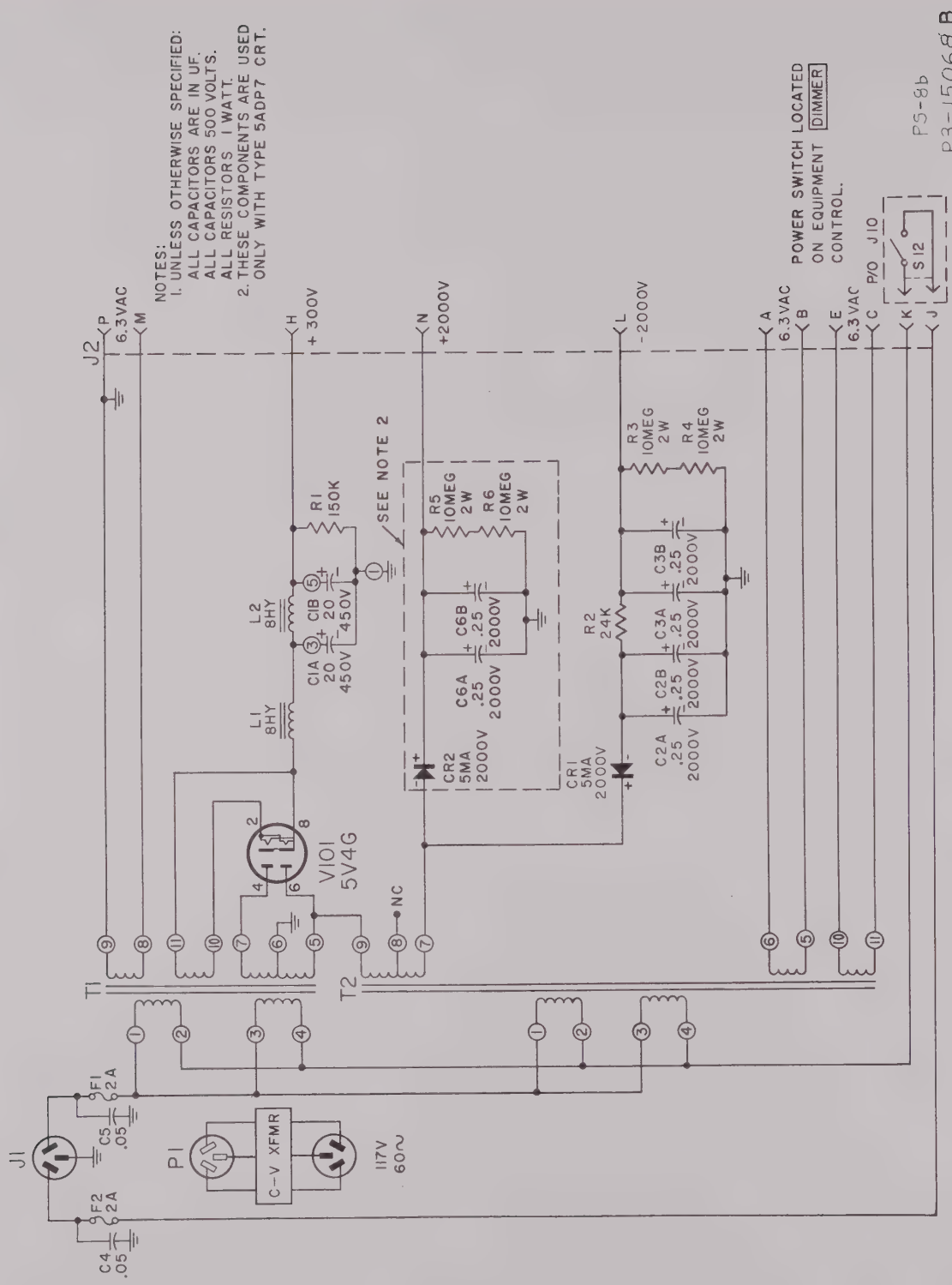


Figure IV-6. Schematic Diagram, Power Supply, Model PS-8b.

R2 and R3, and applied to pin L of connector J2. Through CR2 the voltage is applied to a filter circuit consisting of capacitor C6 and resistors R5 and R6. The output of the filter circuit is a +2000 volt d-c potential, applied to pin N of connector J2 and utilized only when the optional 5ADP7 cathode ray tube is supplied with the equipment. Terminals 10 and 11 supply 6.3 volts ac to pins C and E of connector J2 for application to bridge rectifier CR1 in the Panalyzor.

IV-6. DETAILED DESCRIPTION OF CONSTANT-VOLTAGE TRANSFORMER.

When an alternating current of low voltage is impressed across primary winding (1) as shown in Figure IV-7, the resulting magnetic flux induces a voltage in secondary winding (2). Because of air gap reluctance of the shunt path, this voltage approximates the turn ratio voltage. As the primary voltage is increased, more flux is produced. When flux density causes inductive reactance of winding (2) to approach the value of capacitive reactance of C1 at the exciting voltage frequency, this circuit becomes resonant and the voltage obtained across winding (2) rises rapidly to a stable, predetermined value. This effectively increases magnetic density in that portion of the magnetic circuit on which the resonant winding is wound. Relative reluctance of the shunt system is greatly reduced and subsequent variations in flux largely absorbed, keeping voltage changes in the resonant circuit small. Compensation for these small changes is accomplished with winding (3).

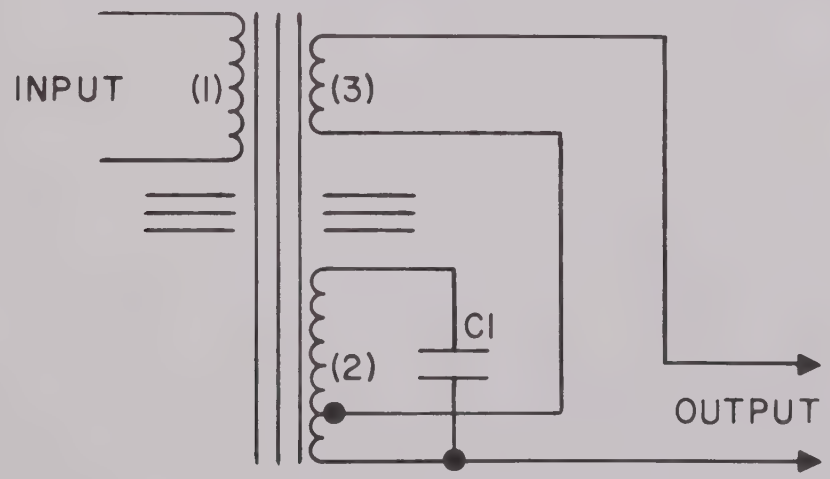


Figure IV-7. Schematic Diagram, Constant-Voltage Transformer.

The shunt system also loosens effective coupling between the resonant circuit and primary winding (1). Once resonance is attained, the primary is required to supply only enough energy to overcome iron and copper losses of the system to maintain oscillation at no load. Because voltage across winding (2) is stable, when resonance is attained it may be used as the basis of the constant voltage output of the transformer.

The transformer output is obtained by tapping winding (2) at a desirable point prior to assembly. Compensating winding (3) is connected series-opposed to output winding (2).

When input voltage varies, it causes a proportional change in the voltage induced in winding (3) which adds to or subtracts from the voltage induced in winding (2). Because of this action, the resultant output voltage remains constant and independent of limited fluctuations in the primary circuit.

The resonant circuit composed of winding (2) and capacitor C1 is broadly tuned to 60 cycles per second. The circulating resonant current produces an IZ drop providing the basic regulated output of the unit. Any change in supply frequency will alter the reactance of the tank and consequently the output voltage. The percentage change in output voltage runs about 1.8 times the percentage change in frequency and in the same direction. Over a limited frequency variation of about ± 5 percent the frequency response of many standard units is a straight line.

Magnetic shunts and high flux densities combine to produce high leakage reactance at secondary currents substantially beyond the rated full load. In the region of 5 to 50 percent overload current this transformer has an output curve similar to any high reactance circuit. This characteristic of the constant voltage principle protects the transformer and its load from excessive fault currents.

CHAPTER V - SERVICE AND MAINTENANCE

This chapter contains adjusting and aligning procedures, troubleshooting information, and a replaceable parts list. When equipment trouble cannot be remedied with the procedures outlined in the following paragraphs, fill out the REPAIR AND MAINTENANCE FORM included in this manual and mail it to Panoramic Radio Products, Inc. Be sure to include the model number and serial number. Upon receipt of this information, our Service Department will send either service data or instructions for shipping the instrument to the factory for repair. If requested, a repair cost will be estimated before servicing the equipment.

V-1. TEST EQUIPMENT.

The test equipment listed below or its equivalent is recommended for servicing and maintaining the Panalyzor equipment.

Quantity	Type or Model Number	Manufacturer
1	A-c Voltmeter, Model 330	Weston Electrical Instrument Corp.
1	Multimeter, Model WV-77A	RCA
1	R-f Signal Generator, Model 82	Measurements Corp.

V-2. EQUIPMENT ADJUSTMENTS.

The controls listed below are screwdriver adjusts, mounted on the Panalyzor chassis and locked with a locking bushing.

a. Vertical Positioning. The baseline may be moved vertically by varying the Vert. Pos. control, see Figure V-1. Relative heights of signals displayed on the baseline will not change as the baseline is raised or lowered. It is possible to move the baseline up or down at least three scale divisions. Set Vert. Pos. control to obtain coincidence between baseline trace and lowest horizontal line on screen. If trace and line are not parallel, rotate crt.

WARNING

Before adjusting the physical position of the crt, turn power off, discharge power supply capacitors C1, C2, C3 and C6 and disconnect cabling between Panalyzor and Power Supply.

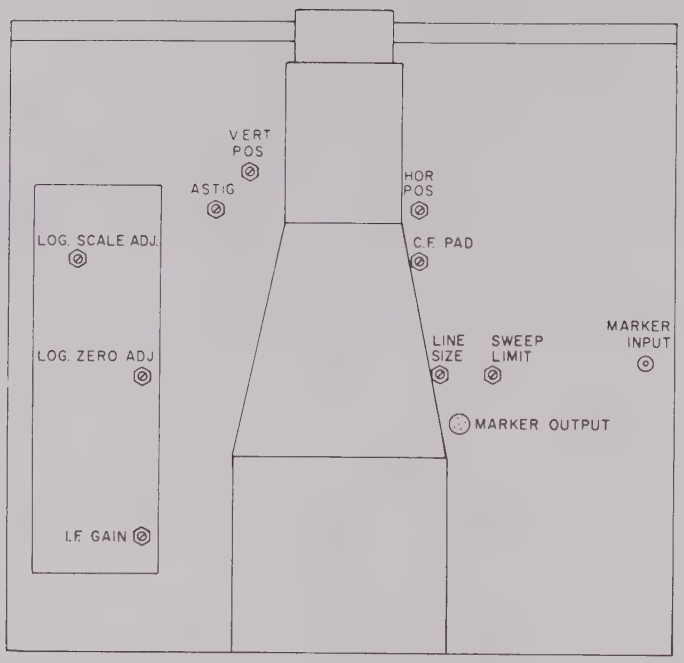


Figure V-1. Adjustment Locations (Panalyzor).

To rotate crt, loosen clamp around crt socket and relax bezel tension on tube by loosening bezel retaining screws. In equipments using a 5UP7 crt, the screen is fitted into detents in the bezel grommet and held in place by tube face pressure. A small adjustment may be made by a slight shift of screen position.

b. Horizontal Positioning. The baseline may be moved horizontally by varying the Hor. Pos. control. Signals displayed as pips on the baseline will move with the baseline. Their relative positions to each other will not change. It is possible to move the baseline horizontally at least two scale divisions in either direction. Apply an external signal to the equipment and set SWEEP WIDTH control to zero position. Adjust CENTER FREQ. control for best baseline rise. Set SWEEP WIDTH control to maximum and adjust Hor. Pos. control until pip is in line with the center frequency calibration on the frequency sweep axis.

c. Line Size. This control linearly expands or contracts the horizontal baseline. Relative positions of signals will not change but resolution capability will be affected. Set Line Size control for a baseline length extending one-half division past each extremity of the frequency sweep axis.

d. Sweep Limit Adjustment. Turn DIFFERENTIAL MARKERS control to its 10 megacycle position. Adjust Sweep Limit control until baseline frequency markers line up at the +5 and -5 vertical lines on the frequency sweep axis.

If equipment is supplied without differential markers, align the sweep limit as follows. Apply a 35-megacycle signal through a .01 microfarad capacitor to pin 5 of V3. Adjust Sweep Limit control until pip coincides with the +5 vertical line on the screen. Apply a 25-megacycle signal through a .01 microfarad capacitor to pin 5 of V3. Adjust Z101 until the pip coincides with the -5 vertical line on the screen. Apply a 30-megacycle signal through a .01 microfarad capacitor to pin 3 of V5. Adjust C.F. Pad until pip appears at center of screen. Repeat these steps until all three frequencies are simultaneously aligned.

e. C.F. Pad Adjustment. Set C.F. Pad until calibrated center frequency pips line up at the frequency sweep axis zero position.

f. Astigmatism Adjustment. Apply a signal to the equipment of sufficient amplitude to cause full scale deflection. Turn INTENSIFIER control 50-percent clockwise and turn BRILLIANCE control to obtain a moderately bright trace. As pip traverses the baseline, adjust Astig. and FOCUS controls until baseline and pip are in sharp focus at all points, or good overall focus is obtained.

g. I-f Gain Adjustment. When overall gain is below specifications, set front panel GAIN control to maximum, RESOLUTION control fully clockwise and AMPLITUDE SCALE selector to LIN position. Apply a 750 microvolt, 30 megacycle signal to the equipment and adjust I.F. Gain potentiometer for full scale deflection.

h. Log Scale Adjustment. With scale selector in LIN position, apply a 750-microvolt, 30 megacycle signal to the equipment and check for full scale deflection. Turn scale selector to LOG position and increase input amplitude to 7500 microvolts. Set Log Scale Adjust to obtain full scale deflection.

i. Log Zero Adjustment. With scale selector in LIN position, apply a 750-microvolt, 30-megacycle signal to the equipment and check for full scale deflection. Turn scale selector to LOG position and set Log Zero Adjust until the deflection indicates zero db.

NOTE

Because of circuit interaction, log scale adjustments may have to be repeated until the log scale is correctly calibrated.

V-3. TROUBLESHOOTING.

Most parts of the equipment are readily accessible and are easily replaced. When a replacement requires removal of wires, mark disconnected wires to eliminate rewiring errors. When replacing parts in r-f or i-f circuits, be sure replacements are the same physical size and mounted in the same posi-

tion as the original part. Failure to observe these precautions may result in decreased gain or undesirable oscillations in the circuit.

The troubleshooting paragraphs and charts on the following pages may be used as an aid in locating causes of equipment malfunctions. The charts list probable causes and remedies of possible equipment failures. When the trouble has been localized, a tube check and voltage and resistance measurements should be sufficient to isolate defective components.

a. Preamplifier DA-1. Preamplifier DA-1 is a straightforward amplifier with a gain of 40 db and a bandpass from 25 to 35 megacycles. A 30 megacycle, 5 millivolt signal applied to connector J1 should produce a 0.5 volt signal at output connector J2. An output voltage tolerance of ±1 db is permissible over the frequency bandpass. A noise figure of less than 9 db should be measured when supplying a 30 megacycle signal to a 50 ohm line (with attenuator out of circuit). If the above specifications are not observed, a check of tubes or of voltages and resistances listed in the voltage and resistance charts should reveal the cause of improper operation.

The power supply in the DA-1 consists of power transformer T1, rectifier tube V7, and associated tube circuitry. Power is applied to the power transformer primary when ON-OFF switch S1 is set to the ON position. Secondary windings of transformer T1 are color coded as indicated in Figure IV-2. Green leads supply 6.3 volts ac through terminals D and E of connectors J3 and P3 to tube filaments. Yellow leads supply 5.0 volts ac to rectifier tube filaments at pins 2 and 8. Red leads supply voltage to rectifier tube plates at pins 4 and 6. The output from the rectifier tubes is applied to a pi-type filter consisting of choke L6 and capacitors C22A and C22B. The +300 volt output of the filter is applied through resistor R17 to pins H of connectors J3 and P3. Regulator tube V8 is connected to the junction of resistor R16 and pin A of connector J3. This tube provides a +150 volt output at pins A of connectors J3 and P3. Any voltage variations are compensated by changing current through the regulator tube which acts as a variable resistor in a divider network.

b. Panalyzor. When troubleshooting the Panalyzor, refer to the following chart and Panalyzor schematic diagram for aid in locating components.

SYMPTOM	PROBABLE TROUBLE	REMEDY
No baseline on screen when power switch S12 is turned on. Pilot lamp T2 does not light.	A-c power not being supplied to the Panalyzor.	Check interconnecting cabling. Check power supply output.
Panalyzor operates normally but pilot lamp T2 does not light.	Pilot lamp or pilot lamp socket defective.	Replace pilot lamp. Check pilot lamp socket.

SYMPTOM	PROBABLE TROUBLE	REMEDY
No baseline is observed on crt screen. Pilot lamp lights.	Improper adjustment of BRILLIANCE, FOCUS, Hor. Pos. or Vert. Pos. controls.	Adjust these controls for the settings recommended in Sections II-4 and V-1.
	Failure of B+ or high voltage supply.	Check power supply.
All voltages present, no illumination on crt.	Defective cathode ray tube.	Change tube.
With GAIN control completely counterclockwise, a dot or short line is observed but horizontal sweep is not obtained.	Faulty sweep stage.	Check sweep tubes V16, V17, V18, and tube socket voltages and resistance.
	Improper adjustment of line size.	Adjust Line Size potentiometer R35 for proper length as specified in Section V-1.
GAIN control counterclockwise. Baseline unstable in CAL and LINE positions of selector switch S11.	Faulty sweep stage.	Check sweep tubes V16, V17, and tube socket voltages and resistances. Replace faulty components.
	Horizontal oscillator circuit not synchronized.	Adjust SYNC AMP control R22 as specified in Section II-4.
Horizontal baseline normal. No vertical deflection when GAIN control is fully clockwise.	No input signals, low amplitude input signals, or off-frequency signals are being applied.	Check r-f cables from preamplifier or check signal source.
	Defective vertical deflection circuit.	Check deflection tubes V14 and V15 and tube socket voltages and resistances.

SYMPTOM	PROBABLE TROUBLE	REMEDY
With SWEEP WIDTH control set, at maximum, a vertical deflection representing a 30 megacycle signal does not line up with the center frequency line on the frequency sweep axis.	Improper adjustment of C.F. Pad, Hor. Pos., or CENTER FREQ. control.	Adjust these controls as specified in Sections II-4 and V-1.
With SWEEP WIDTH control set at maximum, no vertical signal deflection is observed but baseline appears to rise vertically or tilt at an angle.	Defective reactance oscillator section.	Check V4, V5, V6, V7, V8 and V20.
	Z101 detuned, SWEEP WIDTH control misadjusted, or defective.	Refer to Section V-4. Check SWEEP WIDTH control.
Signal frequencies are not indicated accurately.	Improper alignment of bandpass amplifier.	Perform alignment procedures of Section V-4.
	Tubes V1, V2 defective.	Check tubes and socket voltages.
With SWEEP WIDTH control set at maximum, a vertical deflection representing a signal appears as a shift in the baseline.	Defective reactance tube modulator V4 and V5.	Check tube and socket voltages and resistances. Replace faulty components.
Horizontal baseline does not span the desired limit with controls adjusted properly.	Defective horizontal sweep tubes V16 and V17.	Check tubes and socket voltages and resistances. Replace faulty components.

SYMPTOM	PROBABLE TROUBLE	REMEDY
With SWEEP WIDTH and RESOLUTION controls fully clockwise and scale switch set to LIN position, tuning a signal across the bandpass does not result in a response as shown in Figure IV-6.	Improper r-f alignment.	Check V1, V2 and socket voltages and resistances. Replace faulty components.
	If 35 megacycle end of response is low, SWEEP LIMIT control R32 may be misadjusted.	Adjust SWEEP LIMIT control.
	Reactance oscillator off frequency.	Check alignment of reactance oscillator. Refer to Section V-4.
With GAIN and RESOLUTION controls fully clockwise, SWEEP WIDTH control 3/4 clockwise and scale switch to LIN position, a 30 megacycle input signal of 750 microvolts does not produce a full scale symmetrical deflection. Spurious signals appear as input amplitude is varied.	Improper i-f and video alignment.	Check V3, V9, V10, V11, V13, V14, and socket voltages and resistance. Replace faulty components.
	Regeneration in i-f strip.	
RESOLUTION control has no effect on pip shape.	Defective tube V11.	Check tube and socket voltages and resistances. Replace faulty components.
	Defective potentiometer R910.	Check continuity of potentiometer. Replace if necessary.

SYMPTOM	PROBABLE TROUBLE	REMEDY
With GAIN and RESOLUTION controls fully clockwise, SWEEP WIDTH control 3/4 clockwise, and scale switch to LIN position, rotation of RESOLUTION control counterclockwise produces erratic or intermittent pip.	Noisy potentiometer R910.	Replace potentiometer.
With SWEEP WIDTH and RESOLUTION controls fully clockwise and scale switch set to LIN position erratic indications are observed at sweep extremes.	Defective mixer tube circuit.	Replace V3. Several tubes may have to be tried before one is found with proper tube characteristics for the circuit. Z102 may require alignment.
60 or 120 cycle per second modulations on signals.	Defective limiter tube V8 or voltage regulator V20.	Replace tubes.
LOG scale calibration is inaccurate.	Log Scale adjust and Log Zero adjust potentiometers are misaligned.	Check V13, V14 and socket voltages and resistances. Adjust Log Scale and Log Zero potentiometers.
EXP scale calibration is inaccurate.	Defective V23 or CR2.	Check tube and crystals.
With no signal input the horizontal trace cannot be adjusted vertically to line up with the frequency scale.	Defective Vert. Pos. control or tube V15.	Check tube and socket voltages and resistances. Check Vert. Pos. potentiometer. Replace defective parts.
	Regenerative i-f or video stages.	Check V3, V9, V10, V11, V13, V14 and socket voltages and resistances.

SYMPTOM	PROBABLE TROUBLE	REMEDY
With scale switch in LIN position the tops of pips flatten before full scale deflection is reached.	Amplifier stages have reached saturation.	Check all tubes in the r-f, i-f, and video stages.
	I.F. Gain control misadjusted.	Adjust control as specified in Section V-4.
No markers appear when MARKER AMP control is rotated clockwise or do not track properly when DIFFERENTIAL MARKERS control is rotated.	Defective control R945 or switch S941.	Check voltages and resistances.
	Defective V24 and V25.	Check tubes, replace if necessary.
	Marker circuit detuned.	Realign circuit as specified in Section V-4.
Only one marker when MARKER AMP is clockwise and DIFFERENTIAL MARKERS control is set anywhere off zero.	If plus marker does not appear, V25 stage is defective.	Check V25 and replace if necessary.
	If minus marker does not appear V24 stage is defective.	Check V24 and replace if necessary.

c. Power Supply, PS-8b. When troubleshooting the Model PS-8b, refer to the following chart and to schematic diagram Figure IV-6 for aid in locating components.

SYMPTOM	PROBABLE TROUBLE	REMEDY
No +2000 volts at connector J2 terminal N.	Fuses F1 and F2 open.	Replace fuses.
	Open primary or secondary of transformer T2.	Replace transformer T2.
	Defective rectifier CR2.	Replace rectifier.
	Defective power switch.	Replace POWER OFF DIMMER switch S12.
Low +2000 volt output.	Low input voltage.	Check line voltage.
	Defective rectifier CR2.	Replace rectifier.
Ripple on +2000 volt output.	Defective CR2.	Replace rectifier.
	Filter capacitor C6 defective.	Replace capacitor.
No +300 volt output at J2-H.	Fuses F1 and F2 open.	Replace fuses.
	Open primary or secondary of T1.	Replace transformer.
	Defective rectifier tube V101.	Replace tube.
	Open coils L1 or L2.	Check coils, replace if necessary.
Low +300 volt output.	Defective rectifier tube V101.	Replace tube.
	Low input voltage.	Check input voltage.
Ripple on +300 volt output.	Defective filter circuit components.	Check L1, L2 and C1. Replace defective parts.

SYMPTOM	PROBABLE TROUBLE	REMEDY
No -2000 volt output at J2-L.	Fuses F1 and F2 open.	Replace fuses.
	Open primary or secondary of transformer T2.	Replace transformer T2.
	Defective rectifier CR1.	Replace rectifier.
	Defective power on switch.	Replace POWER OFF DIMMER switch S12.
Low -2000 volt output.	Low input voltage.	Check input voltage.
	Defective rectifier.	Replace rectifier.
Ripple on -2000 volt output.	Defective rectifier CR1.	Replace rectifier.
	Filter capacitors C2 and C3 defective.	Replace capacitors.
No 6.3 volts ac between J4-M and J4-P.	No input voltage.	Check input voltage.
	Open secondary of T1.	Replace transformer T1.
No 6.3 volts ac between J2-A and J2-B, J2-C and J2-E.	No input voltage.	Check input voltage.
	Open secondaries of T2.	Replace transformer T2.

d. Constant-Voltage Transformer. The constant-voltage transformer is a simple rugged device without moving parts or manual adjustments. No servicing or maintenance is needed in the ordinary sense. The transformer is designed to operate at high flux density and relatively high temperatures. After connection to a power line for 30 minutes or longer, the exposed core structure may be too hot to touch with bare hands. This temperature is normal. However, if any indication of oil or compound leakage is observed, the unit should be returned to the factory.

A check of the transformer with a purely resistive load equal to the specified VA rating will definitely establish whether or not the unit is defective.

If indications show that the transformer is operating normally, external factors affecting its performance should be investigated. These factors may cause erroneous readings and are among those listed in the following chart of items to be checked.

SYMPTOM	PROBABLE TROUBLE	REMEDY
Output voltage indication too high.	The voltmeter may be a rectifier type.	Output harmonics may cause rectifier types to indicate inaccurately. Voltage checks must be made with a dynamometer type voltmeter (e.g. Weston Model 330) for accurate results. Reasonably close checks can be made with iron vane or thermocouple types.
	Input frequency too high.	Check input frequency.
Output voltage indication too low.	Unit may be overloaded.	Check that the transformer is not supplying power to additional equipment.
	Input frequency too low.	Check input frequency.
Output voltage is not regulated closely.	Line voltage excursions may exceed the rated coverage of the unit, particularly on the low side.	Check power input for variations.
Output voltage very low.	The capacitor in the transformer may be defective.	Check capacitor and replace if necessary.
No output voltage.	Shorted or open input power line.	Check input power line.
	Open primary fuses if any.	Check primary fuses.
	Open input or output terminals.	Perform continuity check of transformer.

V-4. ALIGNMENT PROCEDURE.

a. DA-1 Preamplifier. To align the DA-1 Preamplifier, set Panalyzor front panel controls to the positions listed below.

Control	Position
SWEEP WIDTH	Fully clockwise
RESOLUTION	Fully clockwise
INTENSIFIER	Fully counterclockwise
GAIN	3/4 clockwise (approximately)
AMPLITUDE SCALE	LIN
SWEEP RATE	60 cycles per second
CAL-SYNC SEL	LINE
BRILLIANCE	As desired
FOCUS	To sharpest trace
CENTER FREQ.	On vertical marker
VIDEO FILTER	OUT

With the attenuator switches bypassed, apply a 25-megacycle signal from the Model 82 signal generator to Input connector of the preamplifier. A signal deflection will appear at the right side of the Panalyzor frequency sweep axis. Adjust coil L2 on the preamplifier until maximum deflection is obtained. Apply a 35-megacycle signal and adjust coil L5 on the preamplifier for maximum signal deflection. This signal deflection will appear at the left side of the Panalyzor frequency sweep axis. Apply signals of 28- and 32-megacycles and peak signal deflections with coils L3 and L4 respectively. Tune signal generator between 25 and 35 megacycles and check for overall flatness of response. Because of coil interaction, slight detuning of some peaks may be necessary to acquire the specified flat response.

b. Panalyzor. To align the Panalyzor set the front panel controls to the positions listed for preamplifier alignment, and allow the equipment to warm up for 30 minutes. Because the Panalyzor consists of individual functional circuits, an alignment procedure for each circuit is presented in the following paragraphs.

All tunable coils and transformers of the Panalyzor are movable iron-core types. Primaries are mounted on the upper end of a cylindrical bakelite core and are tuned by a hollow iron core mounted within the bakelite cylinder. The hollow iron core is turned with the pin end of the aligning tool supplied with the equipment. Secondaries are mounted at the lower end of the cylindrical bakelite core and are tuned by a solid iron core mounted within the bakelite cylinder. The solid iron core is turned by inserting the screwdriver tip of aligning tool through the hollow iron core into the slotted head of the solid iron core.

CAUTION

When applying signals from the signal generator to the equipment, place a 0.1 microfarad capacitor in series with the signal generator output to prevent d-c feedback.

1. 500 Kilocycle I-f Circuit Alignment. To align this circuit, set SWEEP WIDTH control fully counterclockwise, and proceed as follows.

(a). Set Model 82 signal generator to 500 kilocycles.

(b). Turn RESOLUTION control fully clockwise.

(c). Apply signal to pin 1 of tube V13.

(d). Tune upper and lower cores of Z107 for maximum signal deflection.

(e). Apply signal to pin 2 of tube V11.

(f). Tune lower core of Z106 for maximum signal deflection.

(g). Turn RESOLUTION control counterclockwise and retune lower core of Z106 for maximum signal deflection.

(h). Apply signal to pin 7 of tube V10, turn RESOLUTION control clockwise and tune upper core of Z106 for maximum signal deflection.

(i). Turn RESOLUTION control counterclockwise and retune upper core of Z106 for maximum signal deflection.

(j). Tune lower core of Z105 for maximum signal deflection.

(k). Turn RESOLUTION control clockwise, set signal generator to 22 megacycles. Tune Z104 for maximum signal deflection.

(l). Set signal generator to 23 megacycles. Retune Z104 for maximum deflection.

(m). Adjust Z104 until the 22 and 23 megacycle signals peak at approximately equal amplitude levels.

2. 23 Megacycle I-f Circuit Alignment. To align this i-f circuit, set SWEEP WIDTH control fully counterclockwise and proceed as follows:

(a). Set Model 82 signal generator to 23 megacycles.

(b). Turn RESOLUTION control clockwise.

(c). Apply signal to the junction of coil Z102 and resistor R900.

(d). Tune Z104 for maximum baseline deflection. Tune lower core of Z103 for maximum signal deflection.

(e). Turn upper core of Z103 fully counterclockwise and then tune for maximum baseline deflection.

(f). Turn RESOLUTION control counterclockwise, retune upper and lower cores of Z103 for maximum baseline deflection.

(g). Turn RESOLUTION control clockwise and apply signal to pin 5 of tube V3.

(h). Tune upper and lower cores of Z102 for maximum baseline deflection.

(i). Turn RESOLUTION control counterclockwise, retune upper and lower cores of Z102 and Z103.

3. Sweeping Oscillator Circuit Alignment. To align the sweeping oscillator circuit, set SWEEP WIDTH control fully clockwise and proceed as follows.

(a). Set Model 82 signal generator to 30 megacycles.

(b). Turn RESOLUTION control counterclockwise.

(c). Apply signal to pin 1 of tube V2.

(d). When pip appears at screen center, decrease sweep width until pip shape may be observed. Use CENTER FREQ. control if necessary.

(e). Tune upper and lower cores of Z102 and Z103 for maximum symmetrical signal deflection. If a signal deflection is not obtained continue to the following steps.

(f). Set CENTER FREQ. control at midpoint.

(g). Apply signal to pin 5 of tube V3.

(h). Adjust C.F. Pad until signal deflection appears at screen center.

(i). Set signal generator to 25 megacycles. Adjust Z101 until signal deflection coincides with left hand edge of screen.

(j). Set signal generator to 35 megacycles. Adjust Sweep Limit control until signal deflection coincides with right hand edge of screen.

(k). Repeat steps (h), (i), and (j) until all three frequencies are aligned with screen calibrations.

(l). Repeat steps (a) through (e).

4. R-f Circuit Alignment. The purpose of the r-f alignment procedure is to obtain a flat response in the r-f circuit. To determine the response characteristic, the signal generator frequency is varied while its amplitude is kept at a constant level. The deflection peak moving across the screen defines the response characteristic. The procedure for aligning the r-f section is as follows.

(a). Set Model 82 signal generator to 23 megacycles.

(b). Set SWEEP WIDTH control fully counterclockwise, RESOLUTION control fully clockwise.

(c). Apply signal to Panalyzor input connector J101.

(d). Tune plate tank circuits LA and LB for minimum baseline deflection.

(e). Set signal generator to 30 megacycles, SWEEP WIDTH fully clockwise.

(f). Apply signal to pin 5 of tube V2.

(g). Set the overcoupling coil of T102 (Figure V-2) approximately at midpoint (1/4 inch of thread exposed). Tune upper core for maximum signal deflection.

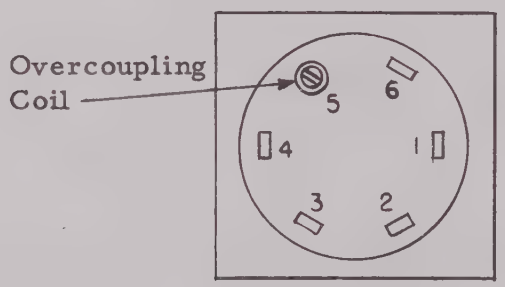


Figure V-2. Bottom View of T101 and T102 Showing Location of Overcoupling Coil Adjustment.

(h). Apply signal to pin 5 of V1.

(i). Turn overcoupling coil of T101 completely counterclockwise and tune upper core for maximum signal deflection.

(j). Set signal generator to 34.8 megacycles.

(k). Apply signal to input jack J101 and tune lower core of T101 for maximum signal deflection.

(l). Set signal generator to 24.8 megacycles.

(m). Tune the overcoupling coil of T101 for maximum signal deflection.

(n). Vary the signal generator between the specified limits of 25 to 35 megacycles. Signal deflection peaks should be of equal amplitude. If not, tune the lower core of T102 to equalize peaking. If the flatness is not within specifications, tune overcoupling choke of T102 to drop lowest peak approximately 10 percent. Then tune lower core of T102 to equalize the peaks. Continue to trim these components alternately until flatness of response is within specifications.

5. Exponential Circuit Alignment. The purpose of this alignment is to compensate for losses incurred by the additional circuitry of the exponential amplifier stages.

(a). Set AMPLITUDE SCALE switch to EXP position.

(b). Set signal generator to 30 megacycles.

(c). Apply signal to input jack J101 on the Panalyzor chassis and adjust signal deflection for one half scale.

(d). Peak L980 for maximum signal deflection and clearest presentation.

6. Differential Marker Circuit Alignment. To align the differential marker circuit, set SWEEP WIDTH control clockwise, RESOLUTION control counterclockwise, SWEEP RATE control to 30 cycles per second, MARKER AMP to OFF and proceed as follows.

(a). Apply a calibrated 30 megacycle signal to input jack J101 of the Panalyzor. Center signal deflection over the zero mark on the frequency sweep axis.

(b). Turn MARKER AMP dial to midpoint.

(c). Turn DIFFERENTIAL MARKERS control to the zero position. Adjust capacitors C940 and C946 to produce a single deflection.

(d). Apply a 35 megacycle signal to input jack J101. Turn DIFFERENTIAL MARKERS control to the ten position. Adjust capacitor C941 until signal deflection and marker pip are in line.

(e). Apply a 25 megacycle signal to input jack J101. Adjust capacitor C943 until signal deflection and marker pip are in line.

(f). Turn DIFFERENTIAL MARKERS control to zero. Readjust capacitors C940 and C946 if necessary.

(g). Turn DIFFERENTIAL MARKERS control to the 5 position.

(h). Apply a 27.5 megacycle signal. Adjust coil L947 until marker pip and signal deflection are in line.

(i). Apply a 32.5 megacycle signal. Adjust coil L940 until marker pip and signal deflection are in line.

(j). Steps (a) through (j) may have to be repeated to obtain good overall tracking of the marker pips.

7. Resolution Circuit Alignment. The procedure for aligning the resolution circuit is as follows.

(a). Apply an audio modulated 30 megacycle signal to jack J101 on the Panalyzor.

(b). Turn RESOLUTION control fully counterclockwise.

(c). Adjust coil Z106 for narrowest signal deflection and maximum amplitude.

c. Power Supply PS-8b. Power Supply PS-8b is designed to operate without the need for operating adjustments. If output voltages are incorrect, check voltages and resistances of tube circuitry. Voltage and resistance indications for the power supply are listed in Section V-5. When a check of the power supply indicates that either power transformer is faulty, and has to be replaced, care should be exercised to avoid miswiring. The 6.3 volt secondary leads (8 and 9) of transformer T1 are connected to one side of bridge rectifier CR1 in the Panalyzor and the 6.3 volt secondary leads (5 and 6) of transformer T2 are connected to the other side. See Figure IV-6 and Panalyzor schematic diagram. The rectifier output supplies a 12-volt filament potential for limiter tube V8 in the Panalyzor. Check voltage across pins 3 and 4 of V8 before putting equipment into operation. The high voltage secondary of T2 is grounded through a section of the high voltage secondary of T1. These secondaries produce the nominal 2000 volt d-c potential for the equipment crt. Measure the voltage before putting the equipment into operation.

V-5. VOLTAGE AND RESISTANCE MEASUREMENTS.

The voltage and resistance measurements listed on the following charts should be used as an aid in locating and isolating causes of equipment malfunctions. These indications are taken from all tube socket pins to ground. An RCA type WV-77A multimeter was used for all measurements. Resistance measurements were taken with the equipment line cord removed and the power switch to the on position. All measurements were taken with the front panel controls in the positions listed below.

Control	Position
CAL-SYNC SEL	Line
SYNC AMP	Normal
SWEEP WIDTH	1.0
SWEEP RATE	30 cycles
RESOLUTION	1.0
CENTER FREQ.	At marker
AMPLITUDE SCALE	LIN
INTENSIFIER	Counterclockwise
FOCUS	Normal
BRILLIANCE	Normal
GAIN	Clockwise
MARKER AMP	Clockwise
MARKER BAL	Clockwise
DIMMER	Clockwise
DIFFERENTIAL MARKERS	Center of dial
VIDEO FILTER	OUT

WARNING

A +1800 volt potential exists on the crt anode cap when a type 5ADP7 cathode-ray tube is supplied with the equipment.

CIRCUIT SYMBOL	TUBE TYPE	PIN 1		PIN 2		PIN 3		PIN 4		PIN 5		PIN 6		PIN 7		PIN 8		PIN 9		PIN 10		PIN 11		PIN 12	
		V	R	V	R	V	R	V	R	V	R	V	R	V	R	V	R	V	R	V	R	V	R	V	R
V1	6BE6	0	51	0.7	220	5AC	**	0	0	260	10K	18	5.6K	0	51	–	–	–	–	–	–	–	–	–	–
V2	6AH6	0	150K	0	0	5AC	**	0	0	260	10K	120	28K	1.8	150	–	–	–	–	–	–	–	–	–	–
V3	6J6	100	25K	21	16K	0	0	5AC	**	4.5	7.5K	4.5	100K	5.5	900	–	–	–	–	–	–	–	–	–	–
V4	6AH6	.05	70K	2.8	100	0	0	6	**	120	12K	150	11K	2.8	100	–	–	–	–	–	–	–	–	–	–
V5	6AH6	.05	70K	2.8	100	0	0	-6	2	120	12K	150	11K	2.8	100	–	–	--	–	–	–	–	–	–	–
V6	6J4	2.2	250K	3.8	150	5AC	**	0	0	2.2	250K	2.2	250K	120	12K	–	–	–	–	–	–	–	–	–	–
V7	6J4	2.2	250K	3.8	150	0	0	5AC	**	2.2	250K	2.2	250K	120	12K	–	–	–	–	–	–	–	–	–	–
V8	12AU6	4.8	150K	0	0	6	2	-6	2	52	70K	52	70K	5.2	1.1K	–	–	–	–	–	–	–	–	–	–
V9	6CB6	0	10	7	4.5K	0	0	5AC	**	257	15K	190	45K	0	0	–	–	–	–	–	–	–	–	–	–
V10	6BE6	-2	4.5K	0	0	0	0	5AC	**	250	15K	53	50K	-1	12K	–	–	–	–	–	–	–	–	–	–
V11	12AT7	260	9K	0	3	4.2	2.2K	5AC	**	5AC	**	240	18K	0	3	3.9	2.2K	0	0	–	–	–	–	–	–
V13	6AH6	0	220K	0	0	0	0	5AC	**	250	15K	100	10K	1.3	150	–	–	–	–	–	–	–	–	–	–
V14	12AU7	90	100K	0	26K	4	650	5AC	**	5AC	**	-0.5	26K	-0.5	26K	.6	200	0	0	–	–	–	–	–	–
V15	12AU7	120	100K	10	130K	16	5.5K	5AC	**	5AC	**	212	60K	0	1	15	27K	0	0	–	–	–	–	–	–
V16	12AT7	83	1MEG	-5	1MEG	.2	1K	5AC	**	5AC	**	95	220K	-48	1MEG	2.4	3K	0	0	–	–	–	–	–	–
V17	6U8	258	7K	-1.5	1MEG	39	19K	0	0	5AC	**	95	450K	0	0	100	25K	95	220K	–	–	–	–	–	–
V18	12AU7	142	200K	0	1.6Meg	10	3.2K	5AC	**	5AC	**	138	220K	13	180K	20	5K	0	0	–	–	–	–	–	–
V20	OD3	–	–	0	0	–	–	–	–	150	11K	–	–	–	–	–	–	–	–	–	–	–	–	–	–
V21	6U8	150	60K	-2	500K	28	9K	0	0	5AC	**	2.5	65K	0	0	5.8	2.5K	0	30K	–	–	–	–	–	–
V23	12AT7	120	100K	11	130K	16	5.5K	5AC	**	5AC	**	260	12K	-8	350K	0.6	4.5K	0	0	–	–	–	–	–	–
V24	12AT7	150	20K	-7	60K	1	200	0	0	0	0	150	20K	1	200	5	550	5AC	**	–	–	–	–	–	–
V25	12AT7	145	20K	-5	60K	1	200	0	0	0	0	145	20K	1	200	4	550	5AC	**	–	–	–	–	–	–
V19	5UP7	-1700	1.7Meg	-1700	2MEG	-1650	1.7Meg	-1200	1.1 Meg	–	–	142	200K	138	220K	150	60K	120	100K	90	100K	–	–	-1700	1.7Meg.
	5ADP7	-1700	1.7Meg	-1650	1.7Meg	-1700	2MEG	–	–	-1200	1MEG	–	–	142	200K	138	220K	150	60K	120	100K	90	100K	–	–

PIN 13		PIN 14	
V	R	V	R
–	–	-1700	1.7 Meg

NOTES: 1 ALL RESISTANCE VALUES IN OHMS AND VOLTAGES IN D-C UNLESS OTHERWISE NOTED.

2. *THESE ARE FACTORY SELECTED RESISTORS AND VALUES MAY VARY IN EACH SET. INDICATIONS SHOWN ARE BASED ON NOMINAL VALUE.

3. **VERY LOW RESISTANCE.

UNIT	CIRCUIT SYMBOL	TUBE TYPE	PIN 1		PIN 2		PIN 3		PIN 4		PIN 5		PIN 6		PIN 7		PIN 8		PIN 9	
			V	R	V	R	V	R	V	R	V	R	V	R	V	R	V	R	V	R
DA-1	V1	6J4	0	**	1.0	100	6.3AC	∞	6.3AC	∞	0	0	0	0	133	∞	–	–	–	–
	V2	6J4	132	40K	133	∞	6.3AC	∞	6.3AC	∞	132	40K	132	40K	200	100K	–	–	–	–
	V3	6CB6	0	**	2.5	240	6.3AC	∞	6.3AC	∞	120	100K	133	100K	0	0	–	–	–	–
	V4	6CB6	0	**	2.5	240	6.3AC	∞	6.3AC	∞	125	100K	135	100K	0	0	–	–	–	–
	V5	6CB6	0	**	2.5	240	6.3AC	∞	6.3AC	∞	100	100K	140	100K	0	0	–	–	–	–
	V6	6J4	0	**	1.5	100	6.3AC	∞	6.3AC	∞	0	0	0	0	142	100K	–	–	–	–
	V7	5Y3	0	0	*400	100K	400	100K	350AC	100	360	100K	350AC	100	360	100K	*400	100K	–	–
	V8	0A2	145	100K	0	0	0	∞	0	0	145	100K	0	∞	0	0	–	–	–	–
PS-8B	V1	5V4G	0	0	280	6.8K	0	0	350AC	120	0	0	350AC	120	0	0	280	6.8K	–	–

NOTES: 1. ALL RESISTANCE VALUES IN OHMS AND VOLTAGES IN D-C UNLESS OTHERWISE NOTED.

2. *THESE ARE FACTORY SELECTED RESISTORS AND VALUES MAY VARY IN EACH SET. INDICATIONS WHOWN ARE BASED ON NOMINAL VALUE.

3. **VERY LOW RESISTANCE.

V-6. LIST OF REPLACEABLE PARTS.

The following replaceable parts for Panalyzor, Model SB-8b, equipment are divided into three individual lists. Each list represents the replaceable parts for an equipment section. In cases where an item appears more than once, total quantity in the entire section is listed the first time the item appears. A legend of code letters used to designate manufacturers immediately follows the parts list. Values and ratings of components are nominal and variations may exist in some equipments. In cases where variations exist, use exact replacement of component found in equipment. When ordering parts from the factory, always include the following information: Instrument model number, serial number, Panoramic part number and part description.

DA-1 Replaceable Parts

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
C1		Capacitor: fixed, ceramic disc .01 uf, 500 vdc Pan Part CC2003-17	AC 36-103W	19		
C2		Capacitor: fixed, ceramic disc .01 uf, 500 vdc Pan Part CC2003-17	AC 36-103W	-		
C3		Capacitor: fixed, silvered mica 51 uuf, ±5% Pan Part CM15C510J	AP CM-15	4		
C4		Capacitor: fixed, ceramic disc .01 uf, 500 vdc Pan Part CC2003-17	AC 36-103W	-		
C5		Capacitor: fixed, ceramic disc .01 uf, 500 vdc Pan Part CC2003-17	AC 36-103W	-		
C6		Capacitor: fixed, ceramic disc .01 uf, 500 vdc Pan Part CC2003-17	AC 36-103W	-		

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
C7		Capacitor: fixed, silvered mica 51 uuf, ±5% Pan Part CM15C510J	AP CM-15	-		
C8		Capacitor: fixed, ceramic disc .01 uf, 500 vdc Pan Part CC2003-17	AC 36-103W	-		
C9		Capacitor: fixed, ceramic disc .01 uf, 500 vdc Pan Part CC2003-17	AC 36-103W	-		
C10		Capacitor: fixed, silvered mica 51 uuf, ±5% Pan Part CM15C510J	AP CM-15	-		
C11		Capacitor: fixed, ceramic disc .01 uf, 500 vdc Pan Part CC2003-17	AC 36-103W	-		
C12		Capacitor: fixed, ceramic disc .01 uf, 500 vdc Pan Part CC2003-17	AC 36-103W	-		
C13		Capacitor: fixed, silvered mica 51 uuf, ±5% Pan Part CM15C510J	AP CM-15	-		
C14		Capacitor: fixed, ceramic disc .01 uf, 500 vdc Pan Part CC2003-17	AC 36-103W	-		
C15		Capacitor: fixed, ceramic disc .01 uf, 500 vdc Pan Part CC2003-17	AC 36-103W	-		
C16		Capacitor: fixed, ceramic disc .01 uf, 500 vdc Pan Part CC2003-17	AC 36-103W	-		

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
C17		Capacitor: fixed, ceramic disc .01 uf, 500 vdc Pan Part CC2003-17	AC 36-103W	-		
C18		Capacitor: fixed, ceramic disc .01 uf, 500 vdc Pan Part CC2003-17	AC 36-103W	-		
C19		Capacitor: fixed, ceramic disc .01 uf, 500 vdc Pan Part CC2003-17	AC 36-103W	-		
C20		Capacitor: fixed, ceramic disc .01 uf, 500 vdc Pan Part CC2003-17	AC 36-103W	-		
C21		Capacitor: fixed, ceramic disc .01 uf, 500 vdc Pan Part CC2003-17	AC 36-103W	-		
C22		Capacitor: electrolytic 2 x 15 uf, 450 V Pan Part CE32X150R-1	BD TVL 27 53	1		
C23		Capacitor: fixed, ceramic disc .01 uf, 500 vdc Pan Part CC2003-17	AC 36-103W	-		
C24		Capacitor: fixed, ceramic disc .01 uf, 500 vdc Pan Part CC2003-17	AC 36-103W	-		
F1		Fuse: cartridge, 2A, 250 volt Pan Part F1003	AF AGC-2	2		
F2		Fuse: cartridge, 2A, 250 volt Pan Part F1003	AF AGC-2	-		

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
I1		Lamp: pilot Pan Part B1007	AN 47	1		
J1		Connector: receptacle, r-f Series N Pan Part J1061	AD 82-24	2		
J2		Connector: receptacle, r-f Series N Pan Part J1061	AD 82-24	-		
J3		Connector: receptacle, 5 pin female Pan Part J 2018	AL C5-20S- VRN	1		
L1		Coil: input, step up Pan Part ZN 8320	AZ ZN 8320	1		
L2		Coil: coupling Pan Part ZN 8213	AZ ZN 8213	1		
L3		Coil: coupling Pan Part ZN 8214	AZ ZN 8214	1		
L4		Coil: coupling Pan Part ZN 8215	AZ ZN 8215	1		
L5		Coil: coupling Pan Part ZN 8216	AZ ZN 8216	1		
L6		Coil: reactor, filter choke 8 hy, 85 ma, 250 ohms Pan Part L2008	AH C-1709	1		
L7		Coil: air, 6 turn Pan Part L2064	AZ L2064	1		
L8		Coil: choke Pan Part L2065	AZ L2065	1		

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
P3		Connector: plug, miniature 5 contact male Pan Part P 2024	AL C5-20P- VS/38	1		
R1		Resistor: fixed, composition 200 ohms, ±5%, 1/2 W Pan Part RC20BX201J	AC EB2015	1		
R2		Resistor: fixed, composition 100 ohms, ±5%, 1/2 W Pan Part RC20BX101J	AC EB1015	2		
R3		Resistor: fixed, composition 47,000 ohms, ±5%, 1 W Pan Part RC32BX473J	AC GB4735	2		
R4		Resistor: fixed, composition 47,000 ohms, ±5%, 1 W Pan Part RC32BX473J	AC GB4735	-		
R5		Resistor: fixed, composition 7,500 ohms, ±5%, 2 W Pan Part RC42BX752J	AC HB7525	1		
R6		Resistor: fixed, composition 240 ohms, ±5%, 1/2 W Pan Part RC20BX241J	AC EB2415	3		
R7		Resistor: fixed, composition 1,500 ohms, ±5%, 1/2 W Pan Part RC20BX152J	AC EB1525	1		
R8		Resistor: fixed, composition 240 ohms, ±5%, 1/2 W Pan Part RC20BX241J	AC EB2415	-		
R9		Resistor: fixed, composition 1,200 ohms, ±5%, 1/2 W Pan Part RC20BX122J	AC EB1225	1		

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
R10		Resistor: fixed, composition 240 ohms, ±5%, 1/2 W Pan Part RC20BX241J	AC EB2415	-		
R11		Resistor: fixed, composition 4,700 ohms, ±5%, 1/2 W Pan Part RC20BX472J	AC EB4725	1		
R12		Resistor: fixed, composition 100 ohms, ±5%, 1/2 W Pan Part RC20BX101J	AC EB1015	-		
R13		Resistor: fixed, composition 150 ohms, ±5%, 1/2 W Pan Part RC20BX151J	AC EB1515	5		
R14		Resistor: fixed, composition 150 ohms, ±5%, 1/2 W Pan Part RC20BX151J	AC EB1515	-		
R15		Resistor: fixed, composition 150 ohms, ±5%, 1/2 W Pan Part RC20BX151J	AC EB1515	-		
R16		Resistor: fixed, wirewound 5,000 ohms, 10 W Pan Part RW10X502-6	BG FRL-10	1		
R17		Resistor: fixed, composition 6,800 ohms, ±5%, 2 W Pan Part RC42BX682J	AC HB6825	1		
R22		Resistor: fixed, composition 56 ohms, ±5%, 1/2 W Pan Part RC20BX560J	AC EB5605	2		
R23		Resistor: fixed, composition 390 ohms, ±5%, 1/2 W Pan Part RC20BX391J	AC EB3915	1		

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
R24		Resistor: fixed, composition 56 ohms, ±5%, 1/2 W Pan Part RC20BX560J	AC EB5605	-		
R25		Resistor: fixed, composition 82 ohms, ±5%, 1/2 W Pan Part RC20BX820J	AC EB8205	2		
R26		Resistor: fixed, composition 91 ohms, ±5%, 1/2 W Pan Part RC20BX910J	AC EB9105	1		
R27		Resistor: fixed, composition 82 ohms, ±5%, 1/2 W Pan Part RC20BX820J	AC EB8205	-		
R28		Resistor: fixed, composition 150 ohms, ±5%, 1/2 W Pan Part RC20BX151J	AC EB1515	-		
R29		Resistor: fixed, composition 39 ohms, ±5%, 1/2 W Pan Part RC20BX390J	AC EB3905	1		
R30		Resistor: fixed, composition 150 ohms, ±5%, 1/2 W Pan Part RC20BX151J	AC EB1515	-		
R31		Resistor: fixed, composition 300 ohms, ±5%, 1/2 W Pan Part RC20BX301J	AC EB3015	2		
R32		Resistor: fixed, composition 18 ohms, ±5%, 1/2 W Pan Part RC20BX180J	AC EB1805	1		
R33		Resistor: fixed, composition 300 ohms, ±5%, 1/2 W Pan Part RC20BX301J	AC EB3015	-		

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
S1		Switch: toggle, DPST Pan Part S1028CH	AE ST22K	1		
S2		Switch: toggle, DPDT Pan Part S2009CH	AE 20905	4		
S3		Switch: toggle, DPDT Pan Part S2009CH	AE 20905	-		
S4		Switch: toggle, DPDT Pan Part S2009CH	AE 20905	-		
S5		Switch: toggle, DPDT Pan Part S2009CH	AE 20905	-		
T1		Transformer: power Pan Part T 3004	AH PM 8409	1		
V1		Tube: Type 6J4 Pan Part 6J4	BZ 6J4	3		
V2		Tube: Type 6J4 Pan Part 6J4	BZ 6J4	-		
V3		Tube: Type 6CB6 Pan Part 6CB6	BZ 6CB6	3		
V4		Tube: Type 6CB6 Pan Part 6CB6	BZ 6CB6	-		
V5		Tube: Type 6CB6 Pan Part 6CB6	BZ 6CB6	-		
V6		Tube: Type 6J4 Pan Part 6J4	BZ 6J4	-		
V7		Tube: Type 5Y3 Pan Part 5Y3	BZ 5Y3	1		

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
V8		Tube: Type OA2 Pan Part OA2	BZ OA2	1		
XV1		Socket: tube, 7 pin miniature Pan Part X1105	AO 305BC	7		
XV2		Socket: tube, 7 pin miniature Pan Part X1105	AO 305BC	-		
XV3		Socket: tube, 7 pin miniature Pan Part X1105	AO 305BC	-		
XV4		Socket: tube, 7 pin miniature Pan Part X1105	AO 305BC	-		
XV5		Socket: tube, 7 pin miniature Pan Part X1105	AO 305BC	-		
XV6		Socket: tube, 7 pin miniature Pan Part X1105	AO 305BC	-		
XV7		Socket: tube, octal Pan Part X1020	BH 115001-1NS	1		
XV8		Socket: tube, 7 pin miniature Pan Part X1105	AO 305BC	-		
		SB-8b Replaceable Parts				
C1		Capacitor: fixed, paper, tubular molded plastic .01 uf, 600 vdc Pan Part CT-1038-1	BD 6TM-S1	1		
C2		Capacitor: fixed, paper, tubular molded plastic .047 uf, 400 vdc Pan Part CT-1285-1	BD 4TM-S47	1		

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
C3		Capacitor: fixed, foil mica 2700 uuf, ±10% Pan Part CM30B272K	AP CM30B 272K	2		
C4		Capacitor: fixed, silvered mica 10 uuf, ±5% Pan Part CM20C100J	AP CM20C 100J	1		
C5		Capacitor: fixed, paper, tubular molded plastic .03 uf, 600 vdc Pan Part CT-2010-1	BD 6TM-S3	1		
C6		Capacitor: electrolytic, twistlock 4 x 20 uf, 450 vdc Pan Part CE34X200R-1	BC DFP	1		
C7		Capacitor: fixed, ceramic disc .01 uf, 500 vdc Pan Part CC2003-17	AC 36-103W	21		
C8		Capacitor: fixed, ceramic disc .01 uf, 500 vdc Pan Part CC2003-17	AC 36-103W	-		
C9		Capacitor: fixed, ceramic disc .01 uf, 500 vdc Pan Part CC2003-17	AC 36-103W	-		
C10		Capacitor: fixed, silvered mica 5100 uuf, ±5% Pan Part CM35C512J	AP CM35C 512J	1		
C11		Capacitor: fixed, silvered mica 91 uuf, ±5% Pan Part CM20C910J	AP CM20C 910J	1		

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
C12		Capacitor: fixed, paper, tubular molded plastic .02 uf, 400 vdc Pan Part CT-2073-1	BC 109P-22 304	1		
C13		Capacitor: fixed, paper, oil filled cylindrical, screw neck mounting 8 uf, 600 vdc Pan Part CP41C1XF805K-7	AV 6GA800	1		
C14		Capacitor: fixed, silvered mica 24 uuf, ±5% Pan Part CM20C240J	AP CM20C 240J	1		
C15		Capacitor: fixed, paper, tubular oil filled, axial leads .03 uf, 3000 vdc Pan Part CT-2104-3	AA 3089M	2		
C16		Capacitor: fixed, paper, tubular molded plastic .1 uf, 400 vdc Pan Part CT-2011-10	BB 330401	2		
C17		Capacitor: fixed, silvered mica 510 uuf, ±5% Pan Part CM20C511J	AP CM20C 511J	4		
C18		Capacitor: fixed, paper, tubular oil filled, axial leads .03 uf, 3000 vdc Pan Part CT-2104-3	AA 3089M	-		
C19		Capacitor: fixed, ceramic disc .01 uf, 500 vdc Pan Part CC2003-17	AC 36-103W	-		

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
C21		Capacitor: fixed, silvered mica 1000 uuf, ±5% Pan Part CM25C102J	AP CM25C 102J	1		
C22		Capacitor: fixed, paper, tubular molded plastic .1 uf, 400 vdc Pan Part CT-2011-10	BB 330401	-		
C25		Capacitor: fixed, silvered mica 75 uuf, ±5% Pan Part CM20C750J	AP CM20C 750J	2		
C26		Capacitor: fixed, paper, tubular molded plastic .25 uf, 400 vdc Pan Part CT-2024-4	AM 4P25	-		
C28		Capacitor: electrolytic, twistlock 2000 uf, 15 vdc Pan Part CE31X202E-1	BD TVL-11 68	1		
C29		Capacitor: fixed, paper, tubular molded plastic .47 uf, 200 vdc Pan Part CT-2075-1	BD 2TM-P47	1		
C801		Capacitor: fixed, ceramic disc .01 uf, 500 vdc Pan Part CC2003-17	AC 36-103W	-		
C802		Capacitor: fixed, ceramic disc .01 uf, 500 vdc Pan Part CC2003-17	AC 36-103W	-		
C803		Capacitor: fixed, ceramic disc .01 uf, 500 vdc Pan Part CC2003-17	AC 36-103W	-		

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
C804		Capacitor: fixed, silvered mica 5 uuf, ±10% Pan Part CM20C050K	AP CM20C 050K	3		
C805		Capacitor: fixed, silvered mica 15 uuf, ±5% Pan Part CM20C150J	AP CM20C 150J	2		
C806		Capacitor: fixed, ceramic disc .01 uf, 500 vdc Pan Part CC2003-17	AC 36-103W	-		
C807		Capacitor: fixed, ceramic disc .01 uf, 500 vdc Pan Part CC2003-17	AC 36-103W	-		
C808		Capacitor: fixed, silvered mica 5 uuf, ±10% Pan Part CM20C050K	AP CM20C 050K	-		
C809		Capacitor: fixed, silvered mica 15 uuf, ±5% Pan Part CM20C150J	AP CM20C 150J	-		
C810		Capacitor: fixed, ceramic disc .01 uf, 500 vdc Pan Part CC2003-17	AC 36-103W	-		
C811		Capacitor: fixed, composition .68 uuf, ±20% Pan Part CC2006-15	BE GA	1		
C812		Capacitor: fixed, silvered mica 5 uuf, ±10% Pan Part CM20C050K	AP CM20C 050K	-		
C813		Capacitor: fixed, ceramic disc .01 uf, 500 vdc Pan Part CC2003-17	AC 36-103W	-		

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
C814		Capacitor: fixed, ceramic disc .01 uf, 500 vdc Pan Part CC2003-17	AC 36-103W	-		
C815		Capacitor: fixed, ceramic disc .01 uf, 500 vdc Pan Part CC2003-17	AC 36-103W	-		
C900		Capacitor: fixed, ceramic disc .01 uf, 500 vdc Pan Part CC2003-17	AC 36-103W	-		
C901		Capacitor: fixed, ceramic disc .01 uf, 500 vdc Pan Part CC2003-17	AC 36-103W	-		
C902		Capacitor: fixed, ceramic insulated .01 uf, 600 vdc Pan Part CC1282-14	AG D6-106 BC	6		
C903		Capacitor: fixed, ceramic insulated .01 uf, 600 vdc Pan Part CC1282-14	AG D6-106 BC	-		
C904		Capacitor: fixed, ceramic insulated .01 uf, 600 vdc Pan Part CC1282-14	AG D6-106 BC	-		
C905		Capacitor: fixed, ceramic insulated .01 uf, 600 vdc Pan Part CC1282-14	AG D6-106 BC	-		
C906		Capacitor: fixed, ceramic insulated .01 uf, 600 vdc Pan Part CC1282-14	AG D6-106 BC	-		

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
C907		Capacitor: fixed, ceramic 20 uuf, ±2%, 600 vdc Type NPO Pan Part CC1105-14	AG TCZ-20	2		
C908		Capacitor: fixed, silvered mica 51 uuf, ±5% Pan Part CM20C510J	AP CM20C 510J	2		
C909		Capacitor: fixed, ceramic 20 uuf, ±2%, 600 vdc Type NPO Pan Part CC1105-14	AG TCZ-20	-		
C910		Capacitor: fixed, silvered mica 51 uuf, ±5% Pan Part CM20C510J	AP CM20C 510J	-		
C911		Capacitor: fixed, silvered mica 82 uuf, ±5% Pan Part CM20C820J	AP CM20C 820J	1		
C912		Capacitor: fixed, foil mica 2700 uuf, ±10% Pan Part CM30B272K	AP CM30B 272K	-		
C913		Capacitor: fixed, silvered mica 470 uuf, ±5% Pan Part CM20C471J	AP CM20C 471J	1		
C914		Capacitor: fixed, ceramic insulated .01 uf, 600 vdc Pan Part CC1282-14	AG D6-106 BC	-		
C915		Capacitor: fixed, ceramic disc .01 uf, 500 vdc Pan Part CC2003-17	AC 36-103W	-		

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
C916		Capacitor: fixed, silvered mica 100 uuf, ±5% Pan Part CM20C101J	AP CM20C 101J	5		
C917		Capacitor: fixed, silvered mica 100 uuf, ±5% Pan Part CM20C101J	AP CM20C 101J	-		
C918		Capacitor: fixed, ceramic disc .05 uf, 500 vdc Pan Part CC2123-1	BC 41C105	2		
C919		Capacitor: fixed, ceramic disc .05 uf, 500 vdc Pan Part CC2123-1	BC 41C105	-		
C927		Capacitor: fixed, silvered mica 100 uuf, ±5% Pan Part CM20C101J	AP CM20C 101J	-		
C940		Capacitor: air trimmer, dual variable 7-45 uuf per section Pan Part CV-2052	AQ TD-2A7	4		
C941		Capacitor: air trimmer, dual variable 7-45 uuf per section Pan Part CV-2052	AQ TD-2A7	-		
C942		Capacitor: variable, air, dual differential 10-108 uuf per section Pan Part CV-2066	AZ CV-2066	1		
C943		Capacitor: air trimmer, dual variable 7-45 uuf per section Pan Part CV-2052	AQ TD-2A7	-		

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
C944		Capacitor: fixed, silvered mica 68 uuf, ±5% Pan Part CM20C680J	AP CM20C 680J	2		
C945		Capacitor: fixed, silvered mica 30 uuf, ±5% Pan Part CM20C300J	AP CM20C 300J	2		
C946		Capacitor: air trimmer, dual variable 7-45 uuf per section Pan Part CV-2052	AQ TD-2A7	-		
C947		Capacitor: fixed, silvered mica 30 uuf, ±5% Pan Part CM20C300J	AP CM20C 300J	1		
C948		Capacitor: fixed, silvered mica 68 uuf, ±5% Pan Part CM20C680J	AP CM20C 680J	-		
C949		Capacitor: fixed, silvered mica 100 uuf, ±5% Pan Part CM20C101J	AP CM20C 101J	-		
C950		Capacitor: fixed, ceramic disc .01 uf, 500 vdc Pan Part CC2003-17	AC 36-103W	-		
C951		Capacitor: fixed, silvered mica 100 uuf, ±5% Pan Part CM20C101J	AP CM20C 101J	-		
C952		Capacitor: fixed, ceramic disc .01 uf, 500 vdc Pan Part CC2003-17	AC 36-103W	-		

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
C953		Capacitor: fixed, ceramic disc .01 uf, 500 vdc Pan Part CC2003-17	AC 36-103W	-		
C960		Capacitor: fixed, mica 10,000 uuf, ±10% Pan Part CM35B103K	AP CM35B 103K	2		
C961		Capacitor: fixed, mica 10,000 uuf, ±10% Pan Part CM35B103K	AP CM35B 103K	-		
C962		Capacitor: fixed, silvered mica 270 uuf, ±5% Pan Part CM15E271J	AP CM15E 271J	2		
C963		Capacitor: fixed, paper, oil filled 2 x .25 uf, +20% -10%, 600 vdc Pan Part CP69B4EF254V-1	BD CP69B4 EF254V	1		
C964		Capacitor: fixed, ceramic insulated 100 uuf, ±10%, 600 vdc Pan Part CC1088a-14	AG DB-101 BC	5		
C965		Capacitor: fixed, silvered mica 270 uuf, ±5% Pan Part CM15E271J	AP CM15E 271J	-		
C966		Capacitor: fixed, ceramic insulated 100 uuf, ±10%, 600 vdc Pan Part CC1088a-14	AG DB-101 BC	-		
C967		Capacitor: fixed, ceramic insulated 100 uuf, ±10%, 600 vdc Pan Part CC1088a-14	AG DB-101 BC	-		

Circuit Ref. Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
C968		Capacitor: fixed, ceramic insulated 100 uuf, ±10%, 600 vdc Pan Part CC1088a-14	AG DB-101 BC	-		
C969		Capacitor: fixed, silvered mica 510 uuf, ±5% Pan Part CM20C511J	AP CM20C 511J	-		
C970		Capacitor: fixed, ceramic insulated 100 uuf, ±10%, 600 vdc Pan Part CC1088a-14	AG DB-101 BC	-		
C971		Capacitor: fixed, silvered mica 510 uuf, ±5% Pan Part CM20C511J	AP CM20C 511J	-		
C972		Capacitor: fixed, silvered mica 510 uuf, ±5% Pan Part CM20C511J	AP CM20C 511J	-		
C973		Capacitor: fixed, ceramic disc .01 uf, 500 vdc Pan Part CC2003-17	AC 36-103W	-		
C974		Capacitor: fixed, ceramic disc .01 uf, 500 vdc Pan Part CC2003-17	AC 36-103W	-		
C980		Capacitor: fixed, silvered mica 75 uuf, ±5% Pan Part CM20C750J	AP CM20C 750J	-		
CR1		Rectifier: selenium, bridge type Pan Part CR2010	BA 16S1B1 S1G	1		

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
CR2		Diode: germanium, 1N81A Pan Part CR1N81A	BA 1N81A	1		
CR960		Diode: germanium, 1N34A Pan Part CR1N34A	BA 1N34A	1		
EV19*		Second anode connector Pan Part W4000	BI 3A1	1		
I1		Pilot Lamp: miniature, bayonet 6.3 vac, .15A Pan Part B1007	AN 47	6		
I2		Pilot Lamp: miniature, bayonet 6.3 vac, .15A Pan Part B1007	AN 47	-		
I3		Pilot Lamp: miniature, bayonet 6.3 vac, .15A Pan Part B1007	AN 47	-		
I4		Pilot Lamp: miniature, bayonet 6.3 vac, .15A Pan Part B1007	AN 47	-		
I5		Pilot Lamp: miniature, bayonet 6.3 vac, .15A Pan Part B1007	AN 47	-		
I6		Pilot Lamp: miniature, bayonet 6.3 vac, .15A Pan Part B1007	AN 47	-		
I10		Neon Lamp: double-contact bayonet, special 67-1/2 vdc, 1/4 W Pan Part B2026-M	AZ B2026M	1		

*Z modification equipment only.

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
J10		Connector: receptacle 14 contact male, solid shell Pan Part P2006	AD MS-3102 A-28-2P	1		
J101		Connector: receptacle, r-f Series N Pan Part J1061	AD 82-24	2		
J102		Connector: receptacle, r-f Series N Pan Part J1061	AD 82-24	-		
J103		Connector: receptacle 1 contact female Pan Part J2010	AD 31-003	1		
J105		Connector: receptacle, miniature 5 contact female Pan Part J2018	AL C520S VRN	1		
L801		Coil: choke, r-f 6 turns, #20E wire closewound Pan Part L1-11550-1	AZ L1-115 50-1	1		
L940		Coil: oscillator, 30 - 35 mc Pan Part ZN8368	AZ ZN8368	1		
L941		Coil: oscillator, 25 - 30 mc Pan Part ZN8369	AZ ZN8369	1		
L960		Choke: r-f, ferrite core 100 uh Pan Part L-1112	BF CH-3-3	2		
L961		Choke: r-f, ferrite core 100 uh Pan Part L-1112	BF CH-3-3	-		

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
L962		Choke: r-f Pan Part L1-11550-2	AZ L1-115 50-2	1		
L980		Coil: filter Pan Part ZN8328	AZ ZN8328	1		
LA		Coil: r-f, trap Pan Part ZN8267	AZ ZN8267	2		
LB		Coil: r-f, trap Pan Part ZN8267	AZ ZN8267	-		
P105		Connector: r-f, 1 pin BNC Pan Part P2010	AD 31-012	1		
P106		Connector: plug, miniature 5 contact male Pan Part P2024	AL C5-20P VS/38	1		
R1		Resistor: fixed, composition 620 ohms, ±5%, 1/2 W Pan Part RC20BX621J	AC EB6215	1		
R2		Resistor: fixed, composition 120 ohms, ±5%, 1/2 W Pan Part RC20BX121J	AC EB1215	1		
R4		Resistor: fixed, composition 4.7 megohms, ±5%, 1/2 W Pan Part RC20BX475J	AC EB4755	1		
R5		Resistor: fixed, composition 1 megohm, ±5%, 1/2 W Pan Part RC20BX105J	AC EB1055	4		
R6		Resistor: fixed, composition 1.2 megohms, ±5%, 1/2 W Pan Part RC20BX125J	AC EB1255	1		

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
R7		Resistor: fixed, composition 220,000 ohms, ±5%, 1/2 W Pan Part RC20BX224J	AC EB2245	10		
R8		Resistor: fixed, composition 160,000 ohms, ±5%, 1/2 W Pan Part RC20BX164J	AC EB1645	1		
R9		Resistor: fixed, composition 5600 ohms, ±5%, 1/2 W Pan Part RC20BX562J	AC EB5625	6		
R10		Resistor: fixed, composition 27,000 ohms, ±5%, 1/2 W Pan Part RC20BX273J	AC EB2735	1		
R11		Resistor: variable, composition linear 500,000 ohms, ±10%, 2 W Pan Part RVA504AQ-2J	AC JU5041	3		
R12		Resistor: fixed, composition 68,000 ohms, ±5%, 1 W Pan Part RC32BX683J	AC GB6835	2		
R13		Resistor: variable, composition linear 500,000 ohms, ±10%, 2 W Pan Part RVA504AQ-2J	AC JU5041	-		
R14		Resistor: fixed, composition 100,000 ohms, ±5%, 1/2 W Pan Part RC20BX104J	AC EB1045	4		
R15		Resistor: fixed, composition 1 megohm, ±5%, 1/2 W Pan Part RC20BX105J	AC EB1055	-		

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
R16		Resistor: fixed, composition 1000 ohms, ±5%, 1/2 W Pan Part RC20BX102J	AC EB1025	6		
R17		Resistor: fixed, composition 1 megohm, ±5%, 1/2 W Pan Part RC20BX105J	AC EB1055	-		
R18		Resistor: fixed, composition 220,000 ohms, ±5%, 1/2 W Pan Part RC20BX224J	AC EB2245	-		
R19		Resistor: fixed, composition 100 ohms, ±5%, 1/2 W Pan Part RC20BX101J	AC EB1015	2		
R20		Resistor: fixed, composition 1 megohm, ±5%, 1/2 W Pan Part RC20BX105J	AC EB1055	-		
R21		Resistor: fixed, composition 3000 ohms, ±5%, 1/2 W Pan Part RC20BX302J	AC EB3025	1		
R22		Resistor: variable, composition linear 50,000 ohms, ±10%, 2 W Pan Part RVA503AQ-2J	AC JU5031	3		
R23		Resistor: fixed, composition 820,000 ohms, ±5%, 1/2 W Pan Part RC20BX824J	AC EB8245	1		
R24		Resistor: variable, composition linear, dual 50,000 ohms, 5 megohms, ±20%, 2 W Pan Part RVB503/505BQ-2J	AC JJU-503 2/5052	1		

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
R25		Resistor: fixed, composition 3300 ohms, ±5%, 1 W Pan Part RC32BX332J	AC GB3325	1		
R26		Resistor: fixed, composition 20,000 ohms, ±5%, 1/2 W Pan Part RC20BX203J	AC EB2035	3		
R27		Resistor: fixed, composition 100,000 ohms, ±5%, 1 W Pan Part RC32BX104J	AC GB1045	4		
R28		Resistor: fixed, composition 470,000 ohms, ±5%, 1/2 W Pan Part RC20BX745J	AC EB4745	2		
R29		Resistor: fixed, composition 15,000 ohms, ±5%, 1 W Pan Part RC32BX153J	AC GB1535	3		
R30		Resistor: fixed, composition Factory selected See schematic diagram	-	1		
R31		Resistor: fixed, composition 240,000 ohms, ±5%, 1/2 W Pan Part RC20BX244J	AC EB2245	-		
R32		Resistor: variable, composition linear 2 megohms, ±20%, 2 W Pan Part RVA205BQ-2J	AC JU2052	1		
R33		Resistor: variable, composition 100,000 ohms, ±10%, 2 W Pan Part RV-A1-11124	AC J81071/ SD3056	1		

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
R34		Resistor: fixed, composition 5.6 megohms, ±5%, 1/2 W Pan Part RC20BX565J	AC EB5655	1		
R35		Resistor: variable, composition linear 500,000 ohms, ±10%, 2 W Pan Part RVA504AQ-2J	AC JU5041	-		
R36		Resistor: fixed, composition 100,000 ohms, ±5%, 1 W Pan Part RC32BX104J	AC GB1045	-		
R37		Resistor: fixed, composition 220,000 ohms, ±5%, 1/2 W Pan Part RC20BX224J	AC EB2245	-		
R38		Resistor: fixed, composition 220,000 ohms, ±5%, 1/2 W Pan Part RC20BX224J	AC EB2245	-		
R39		Resistor: fixed, composition 75,000 ohms, ±5%, 2 W Pan Part RC42BX753J	AC HB7535	1		
R40		Resistor: variable, composition linear 5,000 ohms, ±10%, 2 W Pan Part RVA502AQ-2J	AC JU5021	3		
R41		Resistor: fixed, composition 2.2 megohms, ±5%, 1/2 W Pan Part RC20BX225J	AC EB2255	1		
R42		Resistor: fixed, composition 1,000 ohms, ±5%, 1/2 W Pan Part RC20BX102J	AC EB1025	-		

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
R43		Resistor: fixed, composition 10,000 ohms, ±5%, 1/2 W Pan Part RC20BX103J	AC EB1035	6		
R44		Resistor: fixed, composition 5600 ohms, ±5%, 1/2 W Pan Part RC20BX562J	AC EB5625	-		
R45		Resistor: fixed, composition 1.8 megohms, ±5%, 1/2 W Pan Part RC20BX185J	AC EB1855	1		
R46		Resistor: fixed, composition 180,000 ohms, ±5%, 1/2 W Pan Part RC20BX184J	AC EB1845	1		
R47		Resistor: fixed, composition 100,000 ohms, ±5%, 1 W Pan Part RC32BX104J	AC GB1045	-		
R48		Resistor: fixed, composition 100,000 ohms, ±5%, 1 W Pan Part RC32BX104J	AC GB1045	-		
R49		Resistor: fixed, composition 470,000 ohms, ±5%, 1 W Pan Part RC32BX474J	AC GB4745	2		
R50		Resistor: fixed, composition 470,000 ohms, ±5%, 1 W Pan Part RC32BX474J	AC GB4745	-		
R51		Resistor: variable, composition linear 500,000 ohms, 2000 V, 1/2 W Pan Part RVAH504B1-3	AK CM8339	2		

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
R52		Resistor: fixed, composition 270,000 ohms, ±5%, 1 W Pan Part RC32BX274J	AC GB2745	1		
R53		Resistor: variable, composition linear 100,000 ohms, 2000 V, 1/2 W Pan Part RVAH504B1-3	AK CM8339	-		
R54		Resistor: fixed, composition 390,000 ohms, ±5%, 1 W Pan Part RC32BX394J	AC GB3945	1		
R55		Resistor: fixed, composition Factory selected See schematic diagram	-	1		
R56		Resistor: fixed, composition 56,000 ohms, ±5%, 1/2 W Pan Part RC20BX563J	AC EB5635	6		
R57		Resistor: fixed, composition 47,000 ohms, ±5%, 1 W Pan Part RC32BX473J	AC GB4735	4		
R58		Resistor: fixed, composition 100,000 ohms, ±5%, 1/2 W Pan Part RC20BX104J	AC EB1045	-		
R59		Resistor: fixed, composition 51,000 ohms, ±5%, 1/2 W Pan Part RC20BX513J	AC EB5135	2		
R60		Resistor: fixed, composition 220,000 ohms, ±5%, 1/2 W Pan Part RC20BX224J	AC EB2245	-		

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
R61		Resistor: variable, composition linear 5000 ohms, ±10%, 2 W Pan Part RVA502AQ-2J	AC JU5021	-		
R62		Resistor: fixed, composition 10,000 ohms, ±5%, 1/2 W Pan Part RC20BX103J	AC EB1035	-		
R63		Resistor: fixed, composition 470,000 ohms, ±5%, 1/2 W Pan Part RC20BX474J	AC EB4745	-		
R64		Resistor: fixed, composition 2200 ohms, ±5%, 1/2 W Pan Part RC20BX222J	AC EB2225	5		
R65		Resistor: fixed, composition 100,000 ohms, ±5%, 1/2 W Pan Part RC20BX104J	AC EB1045	-		
R66		Resistor: fixed, composition 150,000 ohms, ±5%, 1/2 W Pan Part RC20BX154J	AC EB1545	2		
R67		Resistor: fixed, composition 220,000 ohms, ±5%, 1/2 W Pan Part RC20BX224J	AC EB2245	-		
R68		Resistor: fixed, composition 4700 ohms, ±5%, 1/2 W Pan Part RC20BX472J	AC EB4725	1		
R69		Resistor: fixed, composition Factory selected See schematic diagram	-	1		

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
R70		Resistor: fixed, composition 680,000 ohms, ±5%, 1/2 W Pan Part RC20BX684J	AC EB6845	1		
R71		Resistor: fixed, composition Factory selected See schematic diagram	-	1		
R72		Resistor: fixed, composition 2200 ohms, ±5%, 1/2 W Pan Part RC20BX222J	AC EB2225	-		
R73		Resistor: fixed, composition 220,000 ohms, ±5%, 1/2 W Pan Part RC20BX224J	AC EB2245	-		
R74		Resistor: fixed, composition 33,000 ohms, ±5%, 1/2 W Pan Part RC20BX333J	AC EB3335	1		
R75		Resistor: variable, wirewound (includes S12, SPST switch attached) 6 ohms, 2 W Pan Part RVW060B1-1-S1 or Resistor: variable, wirewound (includes S12, SPST switch attached) 20 ohms, 2 W Pan Part RVW200B1-1-S1	AI GC252 AX RW20+51	1 1		
R800		Resistor: fixed, composition 51 ohms, ±5%, 1/2 W Pan Part RC20BX510J	AC EB5105	5		
R801		Resistor: fixed, composition 51 ohms, ±5%, 1/2 W Pan Part RC20BX510J	AC EB5105	-		

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
R802		Resistor: fixed, composition 220 ohms, ±5%, 1/2 W Pan Part RC20BX221J	AC EB2215	6		
R803		Resistor: fixed, composition 5600 ohms, ±5%, 1/2 W Pan Part RC20BX562J	AC EB5625	-		
R804		Resistor: fixed, composition 62,000 ohms, ±5%, 1/2 W Pan Part RC20BX623J	AC EB6235	1		
R805		Resistor: fixed, composition 2200 ohms, ±5%, 1 W Pan Part RC32BX222J	AC EB2225	-		
R806		Resistor: fixed, composition 150,000 ohms, ±5%, 1/2 W Pan Part RC20BX154J	AC EB1545	-		
R807		Resistor: variable, composition linear 5000 ohms, ±10%, 2 W Pan Part RVA502AQ-2J	AC JU5021	-		
R808		Resistor: fixed, composition 100 ohms, ±5%, 1/2 W Pan Part RC20BX101J	AC EB1015	-		
R809		Resistor: fixed, composition 47,000 ohms, ±5%, 1 W Pan Part RC32BX473J	AC GB4735	-		
R810		Resistor: fixed, composition 47 ohms, ±5%, 1/2 W Pan Part RC20BX470J	AC EB4705	2		

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
R811		Resistor: fixed, composition 47,000 ohms, ±5%, 1 W Pan Part RC32BX473J	AC GB4735	-		
R812		Resistor: fixed, composition 2200 ohms, ±5%, 1 W Pan Part RC32BX222J	AC GB2225	1		
R813		Resistor: fixed, composition 51 ohms, ±5%, 1/2 W Pan Part RC20BX510J	AC EB5105	-		
R814		Resistor: fixed, composition 3300 ohms, ±5%, 1/2 W Pan Part RC20BX332J	AC EB3325	1		
R815		Resistor: fixed, composition 5600 ohms, ±5%, 1/2 W Pan Part RC20BX562J	AC EB5625	-		
R816		Resistor: fixed, composition 15,000 ohms, ±5%, 1/2 W Pan Part RC20BX153J	AC EB1535	1		
R817		Resistor: fixed, composition 1000 ohms, ±5%, 1/2 W Pan Part RC20BX102J	AC EB1025	-		
R818		Resistor: fixed, composition 47,000 ohms, ±5%, 1/2 W Pan Part RC20BX473J	AC EB4735	3		
R819		Resistor: fixed, composition 100,000 ohms, ±5%, 1/2 W Pan Part RC20BX104J	AC EB1045	-		
R820		Resistor: fixed, composition 56,000 ohms, ±5%, 1/2 W Pan Part RC20BX563J	AC EB5635	-		

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
R821		Resistor: fixed, composition 47,000 ohms, ±5%, 1 W Pan Part RC32BX473J	AC GB4735	-		
R822		Resistor: fixed, composition 47,000 ohms, ±5%, 1 W Pan Part RC32BX473J	AC GB4735	-		
R823		Resistor: fixed, composition Factory selected See schematic diagram	-	1		
R900		Resistor: fixed, composition 10 ohms, ±5%, 1/2 W Pan Part RC20BX100J	AC EB1005	1		
R901		Resistor: fixed, composition 47 ohms, ±5%, 1/2 W Pan Part RC20BX470J	AC EB4705	-		
R902		Resistor: fixed, composition 150,000 ohms, ±5%, 1 W Pan Part RC32BX154J	AC GB1545	1		
R903		Resistor: variable, composition 5000 ohms, ±10%, 2 W B taper Pan Part RVA502EQ-2J	AC JB5021	1		
R904		Resistor: fixed, composition 150 ohms, ±5%, 1/2 W Pan Part RC20BX151J	AC EB1515	2		
R905		Resistor: fixed, composition 47,000 ohms, ±5%, 1 W Pan Part RC32BX473J	AC GB4735	-		

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
R906		Resistor: fixed, composition 5600 ohms, ±5%, 1/2 W Pan Part RC20BX562J	AC EB5625	-		
R907		Resistor: fixed, composition 10,000 ohms, ±5%, 1/2 W Pan Part RC20BX103J	AC EB1035	-		
R908		Resistor: fixed, composition 1300 ohms, ±5%, 1/2 W Pan Part RC20BX132J	AC EB1325	1		
R909		Resistor: fixed, composition 5600 ohms, ±5%, 1/2 W Pan Part RC20BX562J	AC EB5625	-		
R910		Resistor: variable, triple tandem composition, C taper 100K - 100K - 5K, ±20%, 1/4 W Pan Part RVB104/104/502F1-1-P1-W2	AI Type 3-45	1		
R911		Resistor: fixed, composition 75,000 ohms, ±5%, 1 W Pan Part RC32BX753J	AC GB7535	2		
R912		Resistor: fixed, composition 75,000 ohms, ±5%, 1 W Pan Part RC32BX753J	AC GB7535	-		
R914		Resistor: fixed, composition 1200 ohms, ±5%, 1/2 W Pan Part RC20BX122J	AC EB1225	1		
R915		Resistor: fixed, composition 10,000 ohms, ±5%, 1/2 W Pan Part RC20BX103J	AC EB1035	-		

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
R916		Resistor: fixed, composition 2200 ohms, ±5%, 1/2 W Pan Part RC20BX222J	AC EB2225	-		
R917		Resistor: fixed, composition 2200 ohms, ±5%, 1/2 W Pan Part RC20BX222J	AC EB2225	-		
R918		Resistor: fixed, composition 220,000 ohms, ±5%, 1/2 W Pan Part RC20BX224J	AC EB2245	-		
R919		Resistor: fixed, composition 150 ohms, ±5%, 1/2 W Pan Part RC20BX151J	AC EB1515	-		
R920		Resistor: fixed, composition 68,000 ohms, ±5%, 1/2 W Pan Part RC20BX683J	AC EB6835	1		
R921		Resistor: variable, composition linear 50,000 ohms, ±10%, 2 W Pan Part RVA503AQ-2J	AC JU5031	-		
R922		Resistor: fixed, composition 15,000 ohms, ±5%, 1 W Pan Part RC32BX153J	AC GB1535	-		
R923		Resistor: fixed, composition 15,000 ohms, ±5%, 1 W Pan Part RC32BX153J	AC GB1535	-		
R924		Resistor: fixed, composition 16,000 ohms, ±5%, 1 W Pan Part RC32BX163J	AC GB1635	1		

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
R925		Resistor: fixed, composition 22,000 ohms, ±5%, 2 W Pan Part RC42BX223J	AC HB2235	1		
R926		Resistor: fixed, composition 5600 ohms, ±5%, 1 W Pan Part RC32BX562J	AC GB5625	1		
R927		Resistor: variable, composition linear 50,000 ohms, ±10%, 2 W Pan Part RVA503AQ-2J	AC JU5031	-		
R928		Resistor: fixed, composition 51,000 ohms, ±5%, 1/2 W Pan Part RC20BX513J	AC EB5135	-		
R929		Resistor: fixed, composition 68,000 ohms, ±5%, 1 W Pan Part RC32BX683J	AC GB6835	-		
R940		Resistor: fixed, composition 56,000 ohms, ±5%, 1/2 W Pan Part RC20BX563J	AC EB5635	-		
R941		Resistor: fixed, composition 220 ohms, ±5%, 1/2 W Pan Part RC20BX221J	AC EB2215	-		
R942		Resistor: fixed, composition 1000 ohms, ±5%, 1/2 W Pan Part RC20BX102J	AC EB1025	-		
R943		Resistor: fixed, composition 220 ohms, ±5%, 1/2 W Pan Part RC20BX221J	AC EB2215	-		

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
R944		Resistor: fixed, composition 10,000 ohms, ±5%, 2 W Pan Part RC42BX103J	AC HB1035	2		
R945 A, B		Resistor: variable, composition dual concentric (includes S941, SPST switch) 1000 ohms (front), 500 ohms (rear) ±20%, 1/2 W Pan Part RVC102/501BK-1-S1	AI CC-C2- 35	1		
R946		Resistor: fixed, composition 10,000 ohms, ±5%, 2 W Pan Part RC42BX103J	AC HB1035	-		
R947		Resistor: fixed, composition 56,000 ohms, ±5%, 1/2 W Pan Part RC20BX563J	AC EB5635	-		
R948		Resistor: fixed, composition 220 ohms, ±5%, 1/2 W Pan Part RC20BX221J	AC EB2215	-		
R949		Resistor: fixed, composition 1000 ohms, ±5%, 1/2 W Pan Part RC20BX102J	AC EB1025	-		
R950		Resistor: fixed, composition 220 ohms, ±5%, 1/2 W Pan Part RC20BX221J	AC EB2215	-		
R951		Resistor: fixed, composition 220 ohms, ±5%, 1/2 W Pan Part RC20BX221J	AC EB2215	-		
R952		Resistor: fixed, composition Factory selected See schematic diagram	-	1		

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
R953		Resistor: fixed, composition 12 ohms, ±5%, 1/2 W Pan Part RC20BX120J	AC EB1205	2		
R954		Resistor: fixed, composition 12 ohms, ±5%, 1/2 W Pan Part RC20BX120J	AC EB1205	-		
R960		Resistor: fixed, composition 1000 ohms, ±5%, 1/2 W Pan Part RC20BX102J	AC EB1025	-		
R961		Resistor: fixed, composition 56,000 ohms, ±5%, 1/2 W Pan Part RC20BX563J	AC EB5635	-		
R962		Resistor: fixed, composition 56,000 ohms, ±5%, 1/2 W Pan Part RC20BX563J	AC EB5635	-		
R963		Resistor: fixed, composition 240,000 ohms, ±5%, 1/2 W Pan Part RC20BX244J	AC EB2445	2		
R964		Resistor: fixed, composition 20,000 ohms, ±5%, 1/2 W Pan Part RC20BX203J	AC EB2035	-		
R965		Resistor: fixed, composition 240,000 ohms, ±5%, 1/2 W Pan Part RC20BX244J	AC EB2445	-		
R966		Resistor: fixed, composition 20,000 ohms, ±5%, 1/2 W Pan Part RC20BX203J	AC EB2035	-		
R967		Resistor: fixed, composition 51 ohms, ±5%, 1/2 W Pan Part RC20BX510J	AC EB5105	-		

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
R968		Resistor: fixed, composition 1200 ohms, ±5%, 2 W Pan Part RC42BX122J	AC HB1225	1		
R969		Resistor: fixed, composition 510 ohms, ±5%, 1/2 W Pan Part RC20BX511J	AC EB5115	2		
R970		Resistor: fixed, composition 10,000 ohms, ±5%, 1/2 W Pan Part RC20BX103J	AC EB1035	-		
R971		Resistor: fixed, composition 10,000 ohms, ±5%, 1/2 W Pan Part RC20BX103J	AC EB1035	-		
R972		Resistor: fixed, composition 510 ohms, ±5%, 1/2 W Pan Part RC20BX511J	AC EB5115	-		
R973		Resistor: fixed, composition 51 ohms, ±5%, 1/2 W Pan Part RC20BX510J	AC EB5105	-		
R975		Resistor: variable, composition linear 300 ohms, ±10%, 2 W Pan Part RVA301AQ-2J	AC JU3011	2		
R976		Resistor: fixed, composition 39 ohms, ±5%, 1 W Pan Part RC32BX390J	AC GB3905	1		
R977		Resistor: variable, composition linear 300 ohms, ±10%, 2 W Pan Part RVA301AQ-2J	AC JU3011	-		

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
R978		Resistor: fixed, composition 560 ohms, ±5%, 1/2 W Pan Part RC20BX561J	AC EB5615	1		
R980		Resistor: fixed, wirewound insulated 2000 ohms, 10 W Pan Part RW10X202R	BG FRL-10- 2K	1		
S10 A, B, C		Rotary Switch: 3 pole, 3 position 1 deck, ceramic Pan Part S1-9395A	AZ S1-9395A	2		
S11 A, B, C		Rotary Switch: 3 pole, 3 position 1 deck, ceramic Pan Part S1-9395A	AZ S1-9395A	-		
S12		See R75				
S13		Rotary Switch: 1 pole, 3 position 1 wafer, bakelite Pan Part S1026-(13)	AZ S1026- (13)	1		
S941		See R945				
T101		Transformer: r-f, 30 MC ±5 MC Pan Part ZN8257	AZ ZN8257	1		
T102		Transformer: r-f, 30 MC ±5 MC Pan Part ZN8269	AZ ZN8269	1		
V1		Electron Tube: 6BE6 Pan Part 6BE6	BZ 6BE6	2		
V2		Electron Tube: 6AH6 Pan Part 6AH6	BZ 6AH6	4		
V3		Electron Tube: 6J6 Pan Part 6J6	BZ 6J6	1		

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
V4		Electron Tube: 6AH6 Pan Part 6AH6	BZ 6AH6	-		
V5		Electron Tube: 6AH6 Pan Part 6AH6	BZ 6AH6	-		
V6		Electron Tube: 6J4 Pan Part 6J4	BZ 6J4	2		
V7		Electron Tube: 6J4 Pan Part 6J4	BZ 6J4	-		
V8		Electron Tube: 12AU6 Pan Part 12AU6	BZ 12AU6	1		
V9		Electron Tube: 6CB6 Pan Part 6CB6	BZ 6CB6	1		
V10		Electron Tube: 6BE6 Pan Part 6BE6	BZ 6BE6	-		
V11		Electron Tube: 12AT7 Pan Part 12AT7	BZ 12AT7	5		
V13		Electron Tube: 6AH6 Pan Part 6AH6	BZ 6AH6	-		
V14		Electron Tube: 12AU7 Pan Part 12AU7	BZ 12AU7	3		
V15		Electron Tube: 12AU7 Pan Part 12AU7	BZ 12AU7	-		
V16		Electron Tube: 12AT7 Pan Part 12AT7	BZ 12AT7	-		
V17		Electron Tube: 6U8 Pan Part 6U8	BZ 6U8	2		

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
V18		Electron Tube: 12AU7 Pan Part 12AU7	BZ 12AU7	-		
V19		Electron Tube: cathode-ray 5UP7 Pan Part 5UP7	BZ 5UP7	1		
V20		Electron Tube: OD3 Pan Part OD3	BZ OD3	1		
V21		Electron Tube: 6U8 Pan Part 6U8	BZ 6U8	-		
V23		Electron Tube: 12AT7 Pan Part 12AT7	BZ 12AT7	-		
V24		Electron Tube: 12AT7 Pan Part 12AT7	BZ 12AT7	-		
V25		Electron Tube: 12AT7 Pan Part 12AT7	BZ 12AT7	-		
X11		Pilot light holder assembly Pan Part B1014CH	AN 81410- 622	1		
X12		Pilot light holder: miniature bayonet Pan Part B2033	AN 7-06	1		
XI10		Neon Glow Lamp Socket Pan Part B2027M	AZ B2027M	1		
XV1		Socket: 7 pin miniature Pan Part X1105	AO 305BC	11		
XV2		Socket: 7 pin miniature Pan Part X1105	AO 305BC	-		

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
XV3		Socket: 7 pin miniature Pan Part X1105	AO 305BC	-		
XV4		Socket: 7 pin miniature Pan Part X1105	AO 305BC	-		
XV5		Socket: 7 pin miniature Pan Part X1105	AO 305BC	-		
XV6		Socket: 7 pin miniature Pan Part X1105	AO 305BC	-		
XV7		Socket: 7 pin miniature Pan Part X1105	AO 305BC	-		
XV8		Socket: 7 pin miniature Pan Part X1105	AO 305BC	-		
XV9		Socket: 7 pin miniature Pan Part X1105	AO 305BC	-		
XV10		Socket: 7 pin miniature Pan Part X1105	AO 305BC	-		
XV11		Socket: 9 pin miniature Pan Part X1100	AO 371BC	10		
XV13		Socket: 7 pin miniature Pan Part X1105	AO 305BC	-		
XV14		Socket: 9 pin miniature Pan Part X1100	AO 371BC	-		
XV15		Socket: 9 pin miniature Pan Part X1100	AO 371BC	-		
XV16		Socket: 9 pin miniature Pan Part X1100	AO 371BC	-		

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
XV17		Socket: 9 pin miniature Pan Part X1100	AO 371BC	-		
XV18		Socket: 9 pin miniature Pan Part X1100	AO 371BC	-		
XV19		Socket: Crt assembly Pan Part X1084	AB 212FTS	1		
		or				
		Socket: Crt assembly, diheptal (used with 5ADP7) Pan Part X2018	AJ 3B14	1		
XV20		Socket: octal Pan Part X1020	BH 115001-1NS	1		
XV21		Socket: 9 pin miniature Pan Part X1100	AO 371BC	-		
XV23		Socket: 9 pin miniature Pan Part X1100	AO 371BC	-		
XV24		Socket: 9 pin miniature Pan Part X1100	AO 371BC	-		
XV25		Socket: 9 pin miniature Pan Part X1100	AO 371BC	-		
Z101		Transformer: r-f oscillator coil, 53 MC, ±5 MC Pan Part ZN8259	AZ ZN8259	1		
Z102		Transformer: r-f, 23 MC Pan Part ZN8260	AZ ZN8260	1		
Z103		Transformer: r-f, 23 MC Pan Part ZN8261	AZ ZN8261	1		

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
Z104		Transformer: coil, oscillator 22.5 MC Pan Part ZN8262	AZ ZN8262	1		
Z105		Transformer: r-f, coil tapped, 500 KC Pan Part ZN8263	AZ ZN8263	1		
Z106		Transformer: r-f, 500 KC Pan Part ZN8264	AZ ZN8264	1		
Z107		Transformer: r-f, 500 KC Pan Part ZN8265	AZ ZN8265	1		
Z108		Coil: low pass filter Pan Part ZN8266	AZ ZN8266	1		
		PS-8b Replaceable Parts				
C1 A, B		Capacitor: electrolytic, plug-in octal base 2 x 20 uf, 450 vdc Pan Part CE52X200R-1	BD PE-2755	1		
C2 A, B		Capacitor: fixed, paper, oil-filled rectangular 2 x .25 uf, 2000 vdc Pan Part CP70D6XJ254X-5	AT CGF-70 71	3		
C3 A, B		Capacitor: fixed, paper, oil-filled rectangular 2 x .25 uf, 2000 vdc Pan Part CP70D6XJ254X-5	AT CGF-70 71	-		
C4		Capacitor: fixed, ceramic disc .01 uf, 500 vdc Pan Part CC2003-17	AC 36-103W	2		

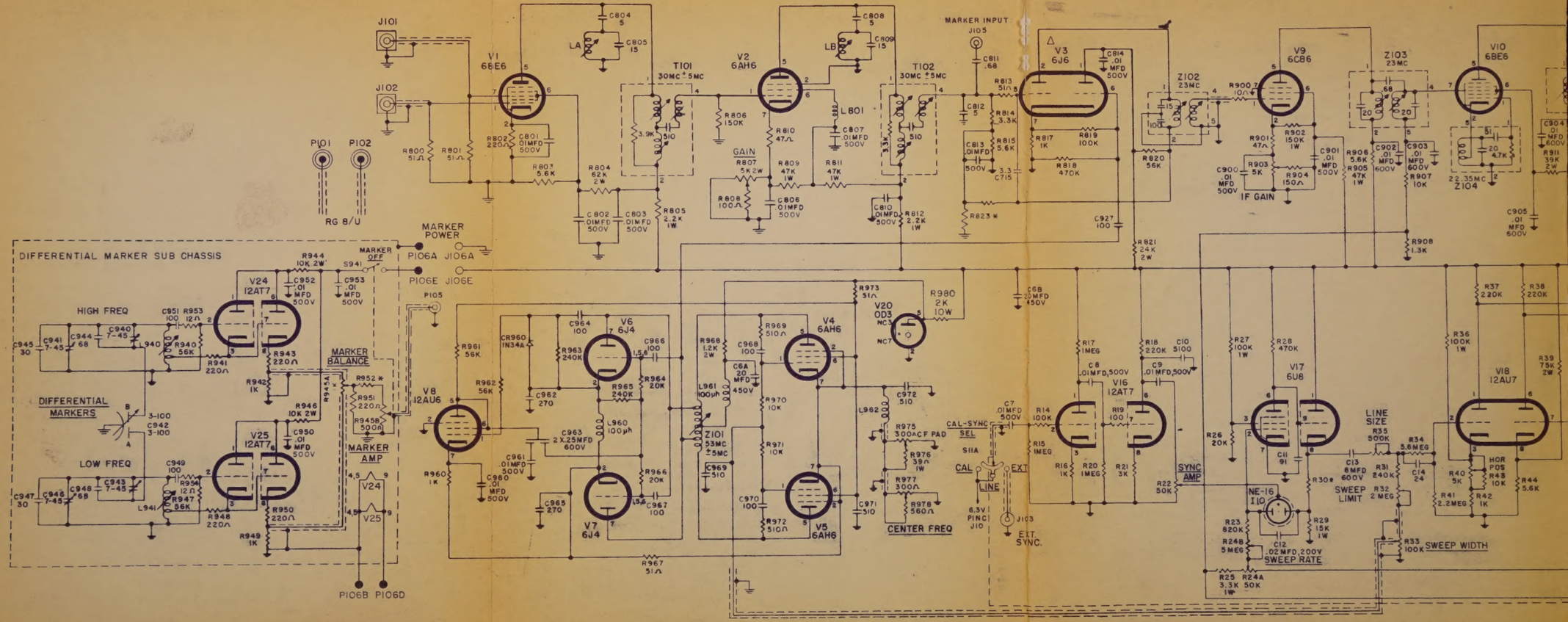
Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
C5		Capacitor: fixed, ceramic disc .01 uf, 500 vdc Pan Part CC2003-17	AC 36-103W	-		
C6 A, B		Capacitor: fixed, paper, oil-filled rectangular 2 x .25 uf, 2000 vdc Pan Part CP70D6XJ254X-5	AT CGF-70 71	-		
CR1		Rectifier: selenium 5 milliamperes, 2000 V Pan Part CR2005	AW V100HF	2		
CR2		Rectifier: selenium 5 milliamperes, 2000 V Pan Part CR2005	AW V100HF	-		
F1		Fuse: cartridge 2 amperes, 250 V Pan Part F1003	AF AGC2	2		
F2		Fuse: cartridge 2 amperes, 250 V Pan Part F1003	AF AGC2	-		
J1		Receptacle: twistlock, male 3-wire Pan Part J1002	AU 7486	1		
J2		Receptacle: box mounting, female 14 contact, solid shell Pan Part J2008	AD MS-3102 A-28-2S	1		
L1		Reactor: filter, 8 Hy Pan Part L2015	AS 1F231	2		
L2		Reactor: filter, 8 Hy Pan Part L2015	AS 1F231	-		

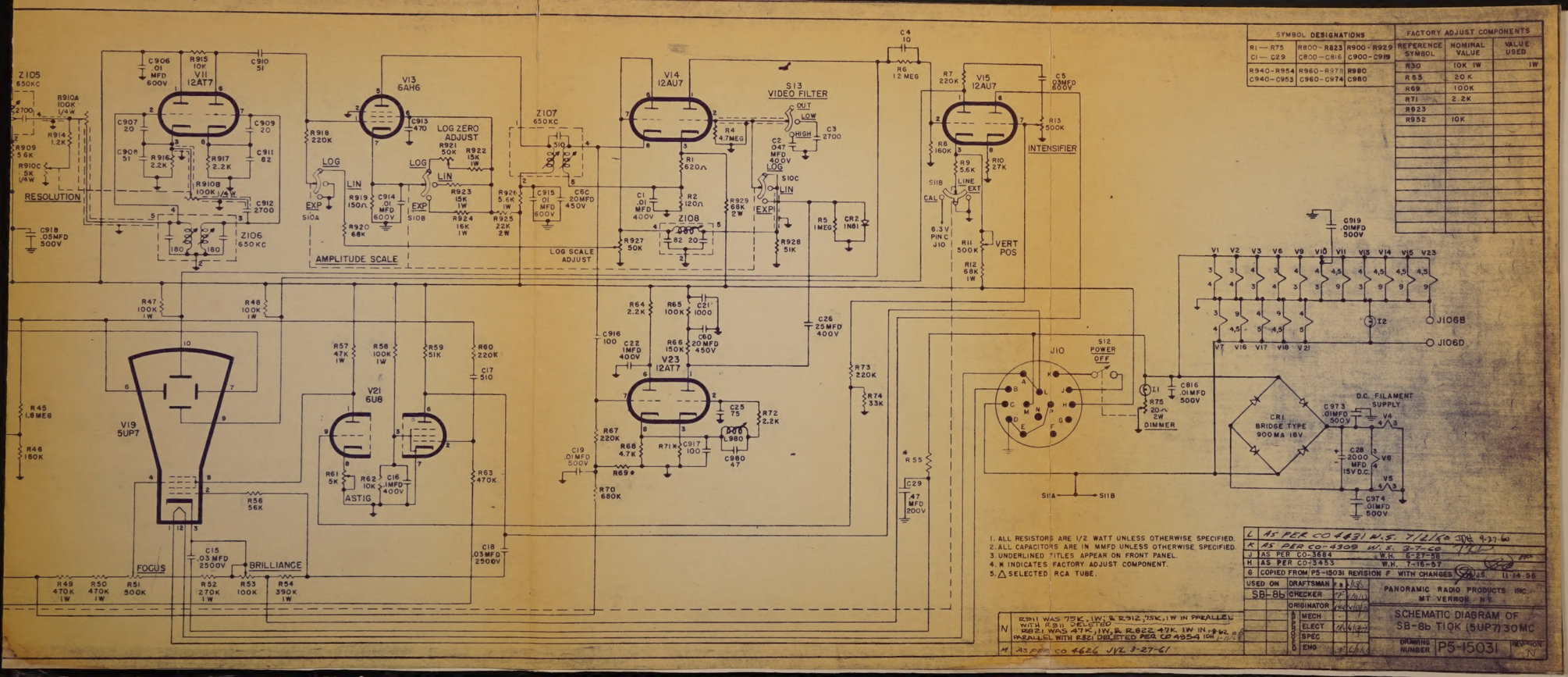
Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
R1		Resistor: fixed, composition 150,000 ohms, ±5%, 1 W Pan Part RC32BX154J	AC GB1545	1		
R2		Resistor: fixed, composition 24,000 ohms, ±5%, 1 W Pan Part RC32BX243J	AC GB2435	1		
R3		Resistor: fixed, composition 10 megohms, ±5%, 2 W Pan Part RC42BX106J	AC HB1065	4		
R4		Resistor: fixed, composition 10 megohms, ±5%, 2 W Pan Part RC42BX106J	AC HB1065	-		
R5		Resistor: fixed, composition 10 megohms, ±5%, 2 W Pan Part RC42BX106J	AC HB1065	-		
R6		Resistor: fixed, composition 10 megohms, ±5%, 2 W Pan Part RC42BX106J	AC HB1065	-		
T1		Transformer: low voltage Pan Part T3-9877B	AZ T3-9877 B	1		
T2		Transformer: high voltage Pan Part T3-9875C	AZ T3-9875 C	1		
V101		Electron Tube: 5V4G Pan Part 5V4G	BZ 5V4G	1		
XF1		Fuse Holder: extractor type Pan Part F2010	AY 342003	2		

Circuit Ref Symbol	Stock No.	Description	Mfr & Mfrs No.	Qty In Set	Qty 3 Mo. Opn	Unit Price
XF2		Fuse Holder: extractor type Pan Part F2010	AY 342003	-		
XV101		Socket: octal Pan Part X1020	BH 115001- 1NS	1		
		Constant-Voltage Transformer Replaceable Parts				
C1		Capacitor: oil-filled 3.5 uf, 660 vac Pan Part CP2022	AR URCAT 49F714	1		
P1		Connector: plug, 3 wire, female Pan Part P1005	AU 7484	1		

MANUFACTURERS CODE FOR LIST OF REPLACEABLE PARTS

AA	Aerovox Corporation
AB	Alden Products Company
AC	Allen-Bradley Company
AD	Amphenol-Borg Electronics Corporation
AE	Arrow-Hart & Hegeman Electric Company
AF	Bussman Fuse Division of McGraw Edison Company
AG	Centralab Division of Globe Union Corporation
AH	Chicago Standard Transformer Corporation
AI	Chicago Telephone Supply Corporation
AJ	Cinch Manufacturing Corporation
AK	Clarostat Manufacturing Company
AL	Continental Connector Company
AM	Cornell Dubilier Electric Corporation
AN	Dialight Corporation
AO	Elco Corporation
AP	Electro Motive Manufacturing Company
AQ	Erie Resistor Corporation
AR	General Electric Company
AS	General Transformer Company
AT	Gudeman Company
AU	Harvey Hubbell Incorporated
AV	Industrial Condenser Corporation
AW	International Rectifier Corporation
AX	International Resistance Company
AY	Littelfuse Incorporated
AZ	Panoramic Radio Products Incorporated
BA	Radio Receptor Corporation
BB	Sangamo Electric Company
BC	Sprague Electric Company
BD	Sprague Products Corporation
BE	Stackpole Carbon Company
BF	Teleradio Engineering Company
BG	Tru-ohm Products Division of Model Engineering & Manufacturing Inc.
BH	United-Carr Fastener Corporation
BI	Ward Leonard Electric Company
BZ	Any EIA Manufacturer


J101
J102
V1 6BE6
LA
C804 5
C805 15
T101 30MC ±5MC
V2 6AH6
LB
C808 5
C809 15
T102 30MC ±5MC
MARKER INPUT J105
C811 .68
V3 6J6
C814 .01 MFD 500V
Z102 23MC
V9 6CB6
Z103 23MC
V10 6BE6
Z104 22.35MC
IF GAIN
P101 P102
RG 8/U
MARKER POWER
P106A J106A
P106E J106E
DIFFERENTIAL MARKER SUB CHASSIS
MARKER OFF
S941
P105
HIGH FREQ
LOW FREQ
DIFFERENTIAL MARKERS
MARKER BALANCE
MARKER AMP
V24 12AT7
V25 12AT7
V8 12AU6
V6 6J4
V7 6J4
V4 6AH6
V5 6AH6
V20 OD3
Z101 53MC ±5MC
GAIN
CENTER FREQ
CAL-SYNC SEL
CAL
LINE
EXT
EXT SYNC.
J103
V16 12AT7
V17 6U8
V18 12AU7
SYNC AMP
LINE SIZE
SWEEP LIMIT
NE-16 I10
SWEEP RATE
SWEEP WIDTH
HOR POS
P106B P106D



SYMBOL DESIGNATIONS		
R1 — R75	R800 - R823	R900 - R929
C1 — C29	C800 - C816	C900 - C919
R940 - R954	R960 - R978	R980
C940 - C953	C960 - C974	C980

FACTORY ADJUST COMPONENTS		
REFERENCE SYMBOL	NOMINAL VALUE	VALUE USED
R30	10K 1W	1W
R55	20 K	
R69	100K	
R71	2.2K	
R823	10K	

1. ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED.
2. ALL CAPACITORS ARE IN MMFD UNLESS OTHERWISE SPECIFIED.
3. UNDERLINED TITLES APPEAR ON FRONT PANEL.
4. ▲ INDICATES FACTORY ADJUST COMPONENT.
5. △ SELECTED RCA TUBE.

N — R911 WAS 75K, 1W, & R912, 75K, 1W IN PARALLEL WITH R911 DELETED. R821 WAS 47K, 1W, & R822 47K, 1W IN PARALLEL WITH R821 DELETED PER CO 4954 10H

M — AS PER CO 4626 JVL 3-27-61

L — AS PER CO 4831 W.S. 7/12/60

K — AS PER CO 4309 W.S. 3-7-60

J — AS PER CO-3684 W.H. 6-27-58

H — AS PER CO-3453 W.H. 7-16-57

G — COPIED FROM P5-15031 REVISION F WITH CHANGES AS LISTED W.S. 11-14-56

USED ON	DRAFTSMAN	
SB-8b	CHECKER	
	ORIGINATOR	
	MECH	
	ELECT	
	SPEC	
	ENG	

PANORAMIC RADIO PRODUCTS INC.
MT VERNON N.Y.

SCHEMATIC DIAGRAM OF SB-8b TIOK (5UP7) 30MC

DRAWING NUMBER P5-15031 REVISION N